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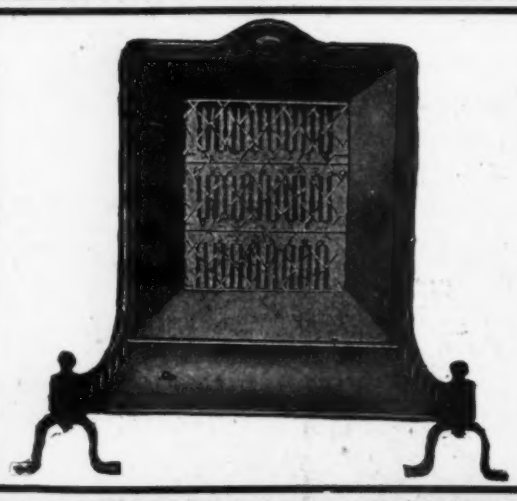

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PROFIT-SHARING AND LABOUR CO-PARTNERSHIP.

THE Intelligence and Statistics Department of the Ministry of Labour has just published a report of 244 pages, bringing the available information on this subject down to 1919, the last previous report having been issued by the Labour Department of the Board of Trade in 1912.

At October 31st, 1919, the number of schemes in existence was 182, representing some quarter of a million employed persons. The total number of schemes known to have been started was 380, one of which dated from 1829, while all the rest had begun since 1865. More than half have been brought to an end, and the average life of the abandoned schemes was about 8½ years. Of the existing schemes, only 36 were inaugurated before 1901, and 95 have commenced since the beginning of 1911. The average life of the schemes now in existence, excluding 29 started during 1919, is about 14 years.

Considered in detail, the report shows that there are very great variations in the numbers of schemes started from year to year; and it is stated that it is difficult to correlate these variations with the fluctuations which occur with greater or less regularity in other industrial statistics. From time to time profit-sharing attracts considerable interest, and great energy is displayed in the devising and inauguration of schemes, then activity dies down, and very little is done for several years. The present time is one in which attention is focussed on profit-sharing as a means by which it is hoped that the identity of the interests of capital and of labour may be more fully recognised by all sides, and the legitimate claims of those concerned may be satisfied.

There can, we think, be little doubt in the minds of any that considerable progress has been made in the democratisation of the outlook of those whose chief concern is with capital. Employers realise that they cannot hope to retain all the profits of manufacture, trading, or commercial enterprise of any kind, while the manual worker remains a wage-slave. There has, in short, been much levelling down. Has the levelling up on the part of labour, of which there has been some, been commensurate?

This is a most difficult question to answer. There is undoubtedly a tendency on the part of many manual workers' Trade Unions to demand that by far the greater part of the profits shall be distributed in the form of wages. We have shown on previous occasions that this tendency is the inevitable result of centuries of inadequate remuneration and deplorable industrial conditions. The only hope of counteracting it is by the education of the mass of workers to that point when they become conscious that all those concerned in the industrial problem—capital, labour, and management—are mutually interdependent and necessary, the one to the other and each to each. When this fact is realised, we believe it will appear obvious that as all are interested in the results, all must do their utmost to attain them; and it seems to us to follow logically that a system of payment by results, or profit-sharing, is the best means of bringing this about.

We know that this has been realised by many of the leaders of thought in the labour world, but it is certain that among the main body it is regarded with suspicion. It is felt that payment by results is bound up with what has been called "scientific management." Process specifications, calling for the performance of a given task in a given way in a given time, hour after hour, day after day, are considered to be destructive of human initiative and enterprise. The man in the works says, in effect: "You may have, on the capitalist side, great responsibilities, enormous issues may depend upon your judgment, and the mental strain involved may occasionally be too great to be

borne; but the life you lead is of an altogether different kind from ours, the reward you reap is greater, and not one of you would change with a typical representative of ourselves." The monotony of daily existence leads to the demand for such pay as will make it possible for the worker, if he wishes, to take a day or two off every week, which means that two days' wages and time produce one day's results.

It would appear, from the statements advanced on behalf of labour, that profit-sharing is opposed because of the close association between the firm and its workpeople, which a good scheme must produce. It is feared that those workpeople will lose interest in the welfare of their fellows in other concerns, and that the solidarity of the Union may, in consequence, be imperilled. Profit-sharing based upon particular firms, then, is not regarded with favour. The attitude of organised labour might possibly be different towards a system of profit-sharing based upon a whole industry, though recent events in the coal world seemed to indicate that a more selfish view existed. It would be very much more difficult to administer schemes having whole industries for their bases. The difficulty of drawing definite boundaries would be great, and a unification of interest among competing undertakings and their shareholders very much closer than anything existing at present, or likely to exist in the near future, would be required.

Profits depend on the organisation of the undertaking, and this is mainly planned and brought into being by the employer, though the trained brain worker plays an important part. They also depend on economical buying of the materials required in manufacture; and management, with clerical assistance which may or may not be organised, is entirely responsible for this part, even in the case of those large closed corporations which cover so much ground as to be practically self-contained. The sale of the finished product is carried out by the same class of workers, and upon efficient selling tactics the profits of any establishment lean very heavily. The concern of organised labour—not, as is sometimes stated, of the *worker*, for the salesmen and buyers, the designers, engineers, and shop superintendents are all workers—is with manufacture, and labour's chief contribution to profit lies in the avoidance of waste, both in time and material.

Organised labour claims that only in this last province can it assist profit-making, and to make the worker's remuneration depend on profits will be to subject him to the operation of forces which he cannot direct or control. Workers of all classes have experienced the undoubted tendency which is manifested in its full evil as completely in the electrical industry as in any other, to cut piece-rates, assign maximum limits to monetary reward, and generally to bring the employé up against a limit. This is strongly resented, and it certainly seems that an expanding system would be more effective in getting the last ounce out of all concerned. If a manager, let us say, received 1 per cent. on the first £10,000 of profit, and 2 per cent. on the second £10,000, would he not be far more interested in putting his whole heart into the advancement of his firm's business than if, as is more generally the case, he were to be paid ½ per cent. on the second £10,000? And this is a consideration which applies to all grades.

Profit-sharing, with its logical corollary, a share in direction and control, has prospered more in the gas supply industry than in any other, but the Report issued by the Ministry of Labour gives a vast amount of detailed information relating to every kind of commercial activity. On one page alone we find such various walks of life as oyster cultivation, printing, tea-blending, paint manufacture, farming, and shipbuilding, and these are schemes which are in existence at the present time. Equally full details, where they are available, are given of the schemes which have come to an end, so that information as to what defects to avoid may be extracted therefrom. The reasons for the abandonment of the schemes are stated, and we find that in some cases employers were dissatisfied, while in others employés were apathetic. We should not like to suppose that in every case where the employers were dissatisfied it was because the workers received too much, and *vice versâ*; but this was at least a probable cause in many instances. Any scheme will be regarded apathetically if it produces insignificant results, and any scheme will be regarded with suspicion if the means by which the results are arrived at are kept secret from those concerned.

The development of the ideal scheme in every case is a difficult business, but we are convinced that it should be boldly tackled, and that the present is the right time to begin.

The Building Trades.

An exhibition in connection with the building trades is now in progress at Olympia. It is strongly held in electrical circles that new buildings should be wired for electricity *ab initio*. Obviously the Building Trades Exhibition is the place for exhibits of electrical wiring systems, and all kinds of domestic electrical apparatus. Consequently the electrical industry, being wide awake and enterprising as behoves a comparatively youthful and energetic member of the building trades, is fully represented and very much in evidence at this exhibition, taking advantage of an excellent opportunity to catch the eye of the architect and engage the interest of the builder—what? *No?* Is it possible that the opportunity has been *missed*? That gas has it all its own way, and that electrical exhibits are almost conspicuously absent from such a show?

Alas!—it is but too true! While the gas interests occupy about a fifth of the floor space, there are not half-a-dozen electrical exhibits of wiring and fittings.

When will the electrical men wake up to the fact that they must seek and obtain publicity, in the right way, and at the right time? Fifteen electrical stands out of 285!—and many of these, though excellent in themselves, in no way connected with the electrical equipment of new buildings—not a single exhibit of installation materials or wiring methods!

The Budget.

On Monday last the Chancellor of the Exchequer (Mr. Austen Chamberlain) made his Budget statement in the House of Commons. For some time past there has been fairly general acknowledgment of the necessity for steps to be taken to put the national finances in a fair way for carrying without unsteadiness the terrible burden imposed by the war. On the whole, it may be said, the nation was in a mood to stand new taxation wherever really necessary for the present in order to secure stability, and to promote abroad confidence in British credit. Increases in various expenses and taxes have been inevitable, and were a foregone conclusion; for example, the higher wages bill of the Post Office has rendered changes in postal, telegraph and telephone rates necessary unless that department is to be conducted at a loss. The Budget is described as a tax on industry, and there is good ground for the criticism, though one cannot easily imagine a practicable alternative. Most of the changes seem likely to have a restrictive and restraining influence upon trade and industry, and we shall need to watch their effect; but the continuing of the Excess Profits Duty has come as a surprise to the industrial world—still more its increase from 40 per cent. to 60 per cent. For some reason or other the impression had got abroad that because it had been so recommended to the Chancellor, the Excess Profits Duty was to give place to another form of tax. Instead of that, the Duty is retained, and increased, while the suggested substitute is to be imposed simultaneously as well, in the form of a Corporation Tax—5 per cent. on undivided profits of limited companies, concerns with less than £500 having exemption. As some sort of solatium, more imaginary than real, it may ultimately prove to be, there is to be due allowance made for the difference of 20 per cent. if any scheme of Capital Levy on war fortunes is brought in later in the year. At the moment of going to press it seems probable that the addition to the Excess Profits Tax may not be approved, owing to the hostile reception accorded to the proposal at Westminster, in the City, and in industrial circles generally. Among the welcome features of the Budget is the promised relief from double Income-Tax within the Empire. It is obvious from the statement of the Chancellor that trade and industry will have to contribute largely to the return of national financial stability. Already the burdens due to industrial conditions

are occasioning continual and serious anxiety, and the troubles of business men promise to become still heavier. Amid all the suggestions, criticisms, and forebodings which are in the air at the moment, we can at least hold it certain that whatever happens, industry and trade will have to make an immense effort if they are going to weather the storm and carry on with profit to themselves after they have met the claims of the State.

A Big German Amalgamation.

A noteworthy event in the German electrical engineering industry that has been under consideration for several months past, is now to take place by the practical amalgamation of two big firms. An official intimation to this effect was made last week, when it was announced that the directors of the Berlin A.E.G. had decided to issue new shares so as to be able to effect an interchange of shares with the Felten & Guilleaume Co., of Cologne, and that the directors of the latter company had resolved to recommend the shareholders to accept the offer. The quotations for the shares of the Cologne company have recently risen largely, partly on rumours of purchases for foreign account, and partly because of reports of a prospective amalgamation, and they stand higher than the shares of the A.E.G.

It may be recalled that close relations have existed between the two companies for a number of years. The first step was taken in 1910, when the prosperity of the Cologne company was threatened through the absorption of the Frankfort works of the Lahmeyer Co. The A.E.G. participated in the reconstruction, and took over the Frankfort works, which, however, was subsequently closed. Shares to the amount of 16,000,000 marks in the F. and G. Co. were acquired for the purpose of establishing a community of interests, and of these shares slightly over 8,000,000 marks are still in the possession of the A.E.G. A new period of development then began, and the efficiency of the Carlswerk considerably increased in intimate co-operation with the Berlin company.

A new factor in the situation has recently risen through a foreign group displaying interest in the Carlswerk. The group, the nationality of which is not disclosed, is said to have held out the prospect of guaranteeing the supply of raw and semi-finished materials to the Cologne company provided that the group were given an interest in the latter by the acquisition of shares. Negotiations on the question are only proceeding slowly, and the result cannot be foreseen. In the meantime, it has been ascertained that shares have passed into foreign ownership. Dealing with the question of pressure from outside, the official communication states that, on the one hand, negotiations would be facilitated if there were one big German shareholder capable of making binding agreements concerning participation in shares, and who, on the other, could form a counterpoise to the influence to be exercised. Having regard to this economic problem, which not only affects the considerable holding of the A.E.G. but also the whole position of the Carlswerk, it was considered natural that such close relations should be established between the two companies also in the matter of capital structure as to be equal to an amalgamation. As a consequence, the directors of both companies have decided to recommend the shareholders to accept an offer on the basis of an interchange of three A.E.G. shares for two shares in the F. and G. Co., which will require 75,000,000 marks of the former for the 50,000,000 marks of the latter. The directors of the A.E.G., therefore, propose to increase the company's share capital by 100,000,000 marks, the difference between this amount and that required to carry out the projected transaction being intended to strengthen the working capital.

As far as can be understood from the official information, the sole object of the scheme is to safeguard the interests of the F. and G. Co. from the invasion of foreign capital to such an extent as to be able to control the Carlswerk. Yet it would have been possible for the directors to have attained this object in another way and without surrendering the independence of the company, namely, by the issue of preference shares having manifold voting rights, as has been already carried out by many companies, and is still being proceeded with by others, in order to prevent foreign capitalists from taking advantage of the depreciated German currency and the state of distress existing in the country. In any case, the success of the scheme of absorption, which is not contingent upon the presentation for interchange of a specified minimum number of shares, appears to be assured, as large blocks of shares in the F. & G. company are held by the directors and their friends. It is, moreover, not improbable that the eyes of the A.E.G. are also pointing in the direction of further acquisitions in the near future, so as to render the company absolutely independent in the matter of all kinds of raw and semi-finished materials for manufacturing purposes.

The Southampton Strike.

The strike of employés of the Southampton Electricity Department, of which we give further particulars to-day, must be regarded as a very regrettable incident. It does not relate to wages or conditions of labour, questions in which public sympathy might be enlisted; the matter at issue is the right of a British citizen to resign from one Trade Union and join another Trade Union.

On the strength of that question—a dispute between Unions, in no way affecting the employers, who in this case are the municipality, a section of the State—the employés went on strike without warning, and did their best to paralyse the diverse activities of the townspeople by cutting off the public supply of electric light, heat, and power. For a short time they were successful, but the engineers, with the help of volunteers, succeeded in restoring the supply, and later new men were engaged, with a firm promise of permanency. Several Unions are involved in the strike, but the Electrical Trades Union, as usual, is the ringleader.

The dispute has now shifted to the question of reinstatement; the Corporation cannot discharge the new men without a gross breach of honour, and the certainty that on a future occasion its word will not be trusted.

To sum up the situation, the men struck without warning, against the community, on a matter with which the community had no concern whatever. Their action was inexcusable and entirely unwarranted, being based upon a dispute that might, and should, have been settled by a friendly conference between the Unions. The strike weapon should never be employed save in the last resort.

[As we go to press, we learn that the strike has been settled by the dismissal of the new men, with two months' pay, and the reinstatement of the strikers.]

Investments in a German Company.

As mentioned in a previous issue, it is proposed to transfer the undertaking of the German Transmarine Electricity Co. to a Spanish group, which is to issue interest bonds and shares in exchange for the ordinary shares in the Germany company, and to redeem the latter's preference shares at the price of 150 per cent., or a premium of 40 per cent. as they are nominally redeemable at 110 per cent. But the holders of the loan capital (bonds or obligations) appear to be receiving scanty consideration. Between 1903 and 1913 the company issued seven series of bonds of the nominal value of 120,000,000 marks, and according to the last balance-sheet, which refers to the end of 1916, bonds for 105,350,000 marks were still in circulation. The bonds which are already terminable, were issued partly outside Germany, and with the exception of the loan of 3,000,000 marks of 1903, which was also issued in English currency (£150,000), they are repayable in German marks at a premium of 3 per cent. Having regard to the enormous depreciation of the mark, considerable concern is being manifested by the holders of the bonds both in Germany and Switzerland, in consequence of the directors of the German company having given notice to redeem all the bonds without delay. If this intention is carried into effect, it will imply a heavy loss to the holders; in Switzerland alone the 1,000-mark bond is only worth about 80 fr., whereas at one time the capital value was 1,250 fr. It is, therefore, suggested that in the interest of German credit abroad, the bonds should also be taken over by the Spanish group, and be redeemed gradually by annual drawings, as is customary.

THE NEW BAKERLOO ROLLING STOCK.

(*Concluded from page* 484.)

Fig. 7 is an interior view of one of the cars; the interior steel panels are painted a dark cream, while the ceiling of the arched roof, which is constructed of agasote, is enamelled flat white. All unnecessary ornamentation is dispensed with, and no roof advertisements are to be placed inside the cars. The seats are upholstered in red and black rep. It will be seen from figs. 7 and 10 that strap-hanging is abolished; in place of the leather straps, strong vertical wooden bars are conveniently placed to give some sort of stability to passengers who are compelled to stand, and metal "grab handles" at the seat ends serve the same purpose. Each

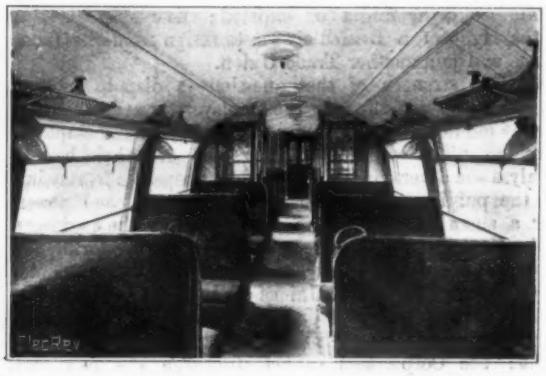


Fig. 7.—Interior of New Bakerloo Coach.

person seated is assured of ample room, and comfortable elbow rests are provided between the longitudinal seats. Hat or light-luggage racks are fitted for the first time in tube railway cars, and below the seats electric heaters are installed.

With regard to ventilation, in addition to the ordinary drop lights, an air duct with perforations runs the whole length of the car. The illumination is by diffused light from opal bowls placed in a row along the centre of the ceiling, and globe lamps at the shoulder provide for passengers who wish to read, as shown in figs. 7 and 10.

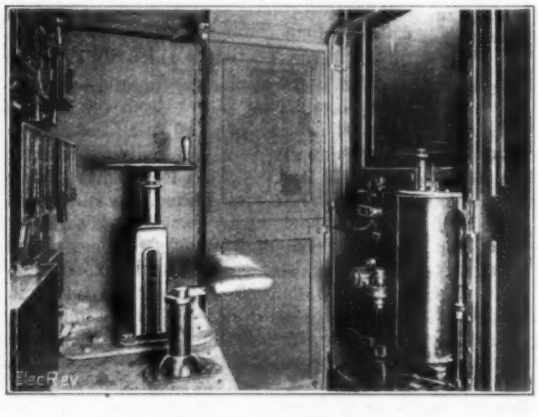


Fig. 8.—Interior of Driver's Cab.

All the cars are fitted with emergency electric lights, which are supplied from accumulators carried on the motor-cars, and arranged in such a manner as to be automatically switched into circuit in the event of the main supply failing at any time.

Fig. 8 is an interior view of the driver's cab, while fig. 9 shows the control contactor gear. Figs. 10 and 11 show elevations, plan, and sections of the motor and trailer cars respectively.

The train control equipment was supplied by the British Thomson-Houston Co., Ltd., and is of the relay-automatic type. The normal method of operation with this system is to place the controller at once to the full parallel position when starting a train. The contactors are then picked up in their correct sequence by the current-limiting relay, which operates as soon as the motor current has dropped to a predetermined value. The relay consists of two shunt coils and one main coil. The latter carries current equal to that of one motor only. The actuating coils of the contactors are energised through one or other of the two shunt coils in such a manner that, if one is energised through one shunt coil, the next one to close will be energised in series with the other shunt coil. The two relay shunt coils act on two plungers controlled by gravity. Each plunger, when in its lower position, closes a disk switch in series with the other shunt coil; but when raised, due to its coil being energised, opens this switch. Thus, when one of the plungers is raised, the shunt coil, acting on the other, cannot be energised because of the break in the circuit produced by the above-mentioned switch, but although it is the control current that raises the plunger, so as to produce this break, it is the current passing through the main coil which maintains the break, and the plunger is not released until this current has dropped to the predetermined value. Then the plunger falls and closes the

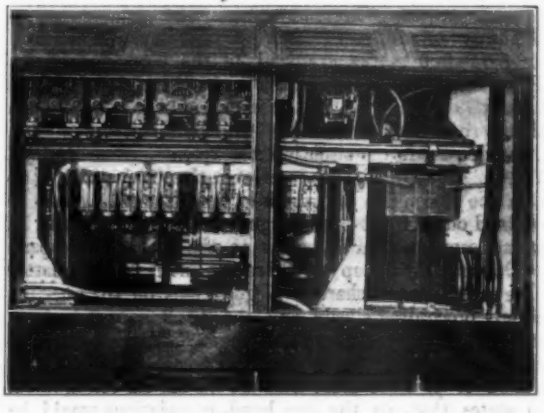


Fig. 9.—Train Control Contactors.

switch which completes the circuit for the next contactor coil to be energised.

The principle underlying the method of control adopted in connection with the current-limiting relay is that, after a contactor has been picked up, as described above, its coil is immediately transferred, by means of interlocks, to another wire. There are thus essentially two operating wires, the picking-up wire and the retaining wire, although other wires are introduced for forward and reverse running, circuit-breaker setting, &c. As there are no main bus lines down the train, a potential relay is fitted on each motor car, which drops all contactors on that car when the shoes lose current. This is necessary, because when no current passes through the main coil of the current-limiting relay, it ceases to exercise its control over the rate of picking-up of contactors.

The controller has four forward points and two reverse (series only), of which Nos. 2 and 4 are running points, where all resistance is cut out. A useful provision in the control is that, if, in the course of the automatic notching up, the controller handle is brought back to the first or third notch, as the case may be, the automatic closing of contactors is stopped, but those already closed are kept up.

The working of the safety button on the controller handle differs from the London Electric Railway standard in that the safety button cannot be released, except when

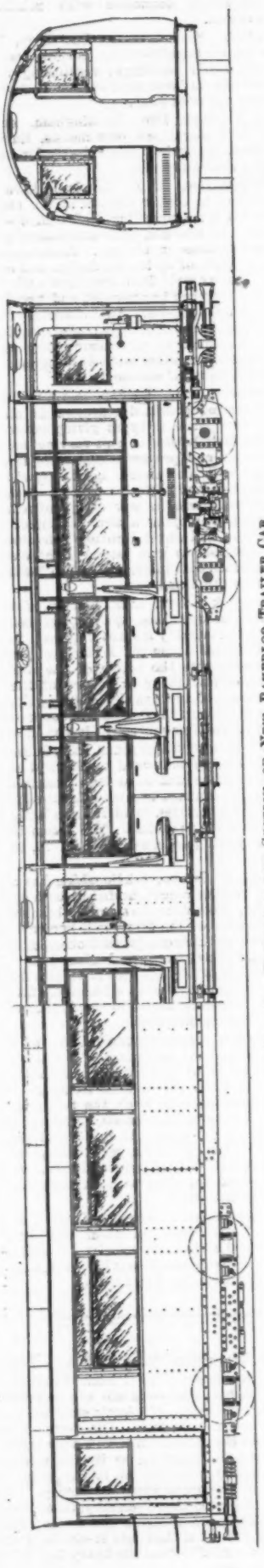


Fig. 10.—Elevation and Section of New Bakerloo Trailer Car.

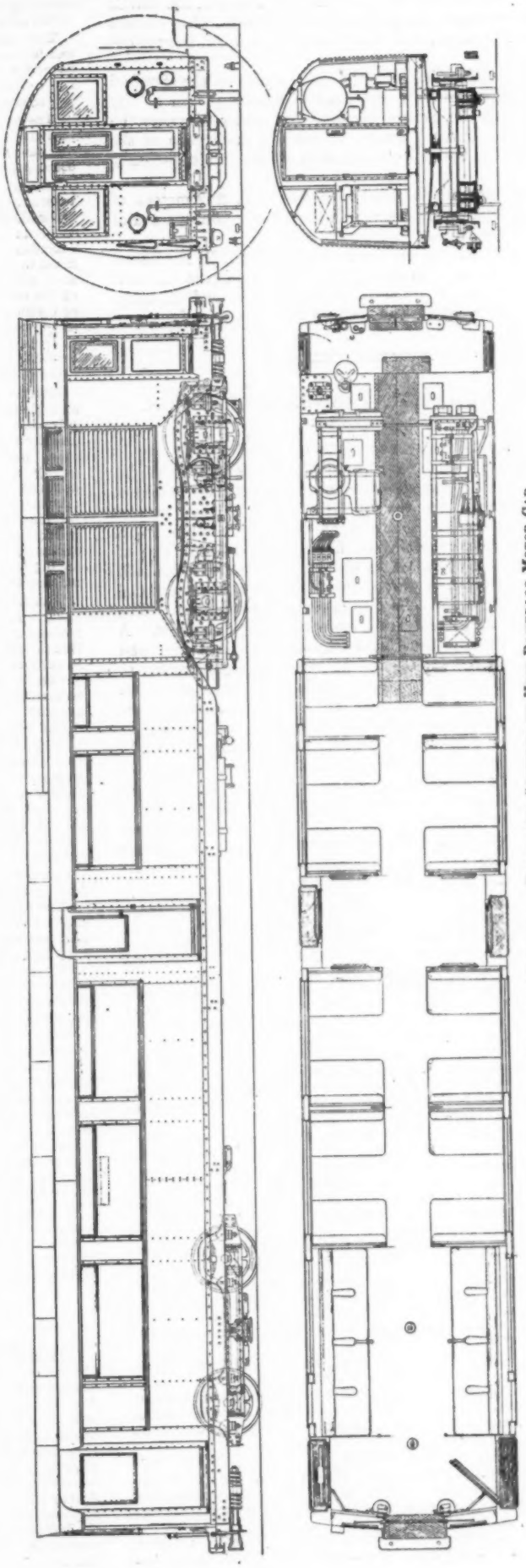


Fig. 11.—Elevation, Plan, and Sections of New Bakerloo Motor Car.

the handle is at the off position. If, however, the handle itself be let go, it flies back to the off position, when current is instantly cut off, and the brakes are applied throughout the train.

Another safety device, which is now part of the standard L.E.R. equipment, is the control circuit governor. By interrupting the control circuits this device prevents the train being driven forward, unless the main pipe of the Westinghouse brake is charged with air and the trip-cock is cut in.

Each motor-car is fitted with two G.E. 212 motors of 240 H.P. each, which are geared for a free running speed of from 40 to 45 M.P.H.

In conclusion, our thanks are due to Mr. A. R. McCallum for providing us with an opportunity to inspect the new stock, and also for the loan of photographs and drawings from which the above illustrations were reproduced.

THE BUILDING TRADES EXHIBITION.

It is exactly 25 years ago since the first building exhibition was held at the Royal Agricultural Hall, London; in 1907 it was transferred to Olympia, where it has since been held biennially up to the year 1913. The present Exhibition, which was opened at Olympia on April 10th, and closes to-morrow, is the first purely technical one of its kind entirely devoted to the building trade, to be held since the outbreak of war, and the promoters have succeeded in assembling a fine collection of materials and plant. The Exhibition is, therefore, of more than usual interest. A party of French gentlemen interested in building, and particularly in refractory goods, was to come to London to attend the Exhibition, and afterwards a conference of French and British manufacturers on refractory goods was to be held. A number of visits and conferences of associations and societies interested in building were arranged to take place during the period the Exhibition remains open.

Although the exhibits are of much interest, there is very little of an electrical nature to be seen; only on some 15 out of a total of nearly 285 stands are electrical goods exhibited. In what follows, a brief description of these exhibits is given, but nothing new was noticed, most of the exhibits having been shown at other recent exhibitions.

The Titan Lift Co., Ltd., London, has on view a five-floor, push-button lift machine of the drum type suitable for carrying four passengers; a service lift suitable for loads of 1 cwt., also push-button controlled, and V-sheave type four and six-passenger machines arranged for push-button or car-switch control.

Messrs. Mann, Egerton & Co., Ltd., London, show self-contained sets for lighting, cooking, and heating, in country houses, both by electricity and by the "Willett" air-gas system.

Messrs. R. A. Lister & Co., Ltd., Dursley, also show an electric lighting and power plant suitable for farms, country houses, &c., of the automatic type, having a capacity of 1 KW. at a pressure of 55 volts. Various sizes of petrol and oil engines, as well as a single ram pump driven by a 2-H.P. petrol engine are also included in this exhibit.

The Rawlplug Co., Ltd., London, has on view patent fibre plugs which are used for fixing screws into any sort of material; the plugs require no skilled handling, nor do they damage the surrounding material, and they are invisible when in position. The exhibit, which attracted well-merited attention at other recent exhibitions, includes excellent specimens of work in all classes of materials. Frequent demonstrations of the uses of rawlplugs and the advantages over the usual method of obtaining a fixture are given.

The Metropolitan-Vickers Electrical Co., Ltd., Manchester, shows a selection of domestic electric heating and cooking devices, as well as electric fans, switches and metallic-filament lamps. A selection of porcelain insulators of various types and sizes is also shown.

Messrs. Petters, Ltd., and Vickers Petters, Ltd., Yeovil, exhibit an electric lighting set, consisting of an internal combustion engine coupled to a 2·5-KW. Metropolitan-Vickers dynamo, generating at a pressure of 50 volts. The set starts on a small quantity of petrol, changing over automatically to paraffin, on which it runs at low fuel costs.

Messrs. Building Products, Ltd., London.—This firm's specialities are interesting to the engineering, as well as to the architectural, profession. "Rigifix" bolt-hanger sockets and slotted inserts are used for embedding in reinforced concrete beams and columns for the purpose of attaching mechanical equipment without the necessity of cutting into the finished concrete. Specimens of various types and fittings and photographs, also miscellaneous specialities connected with reinforced concrete construction, are shown.

The Sturtevant Engineering Co., Ltd., London.—This exhibit consists of electrically-driven turbine vacuum cleaning plant for large and small buildings; ventilating plant and fans; and a 0·5-H.P. portable turbo-electric suction cleaner, with a small power consumption for work done.

Messrs. F. & C. Osler, Ltd., Birmingham, exhibit electric lighting fittings in wrought and cast metals, English alabaster, and cut crystal glass, in classic styles, suitable for use in domestic, ecclesiastical, and public buildings.

Messrs. Waygood-Otis, Ltd., London, have an electric passenger lift working to convey visitors up to, and down from, the gallery. The lift is arranged for dual control—by car switch with an attendant in the car, and automatically without an attendant, by push-buttons in the car. A change-over switch is fitted to the car, which is of up-to-date design and construction of steel and glass. The wrought-iron enclosure work illustrates one of the many designs that can be arranged, and two different forms of position-indicators are shown. An "electroil" lift, consisting of a direct-acting ram beneath the platform, operated by a patent oil pump which is coupled to an electric motor and electrically controlled, is also shown, together with working models of different types of lifts and a number of accessories.

Messrs. Holophane, Ltd., London, exhibit lighting fittings and glassware, including standard reflectors in all sizes; these prismatic reflectors are made in types giving extensive, intensive, and focusing light distribution to suit varying heights of buildings. Reflector bowls and prismatic glassware in four sizes, and giving a strong, soft downward light; semi-indirect units designed for decorative and diffusive effects; "concealed" prismatic shop window reflectors: a new design of reflector-refractor for interior lighting, employing a combination of reflective and refracting properties; and street lighting refractors, a two-piece enclosing bowl designed to give lateral light distribution, and having a smooth surface both inside and out to facilitate cleaning, are also to be seen on this stand.

Messrs. Marryat & Scott, Ltd., London, show a complete electric service lift in operation, the control being effected by momentary pressure on suitably marked buttons. Safety in operation is assured by several fitments. A standard passenger lift car is exhibited to demonstrate the action of the safety gear, which device, in the event of stretching or failure of the lifting ropes, automatically operates and sustains the load by gripping the guide runners. The car is shown fully loaded and supported by the gear. A line of standard controlling equipment is also shown.

Messrs. British Electric Vehicles, Ltd., Churchtown, Southport, show electric battery industrial trucks and an accumulator locomotive similar to those that have been described in our pages from time to time. The trucks are manufactured in five different standard patterns and capacities, in addition to being built to meet special requirements when so desired. The locomotives are manufactured to suit any rail gauge, and to haul 10, 20, and 50 to 75 tons each.

Carron Company, of Carron, Stirlingshire, has a fine show of heating stoves and cooking ranges, heated by both coal and gas as well as by electricity. A considerable space has been set apart for the exhibition of a selection of the firm's well-known electric heating and cooking apparatus, which comprises cookers, grills, fish fryers, hot-plates, electric kettles, irons, and glue pots. There are, in addition, several models of electric fires in various finishes, and the manner in which electric fires can be attractively fitted to existing chimney breasts is effectively shown in one typical example in the form of a complete electric fireplace.

Messrs. Underwood (Manchester), Ltd., of Manchester.—On this stand is exhibited the well-known "moonstone" illuminating glassware, which is of Canadian manufacture throughout, consisting of lighting units for indirect lighting. It is neither opaque nor transparent, but is between the two, and when lighted exhibits a uniform luminous appearance, diffusing the light in a manner very restful to the eyes. It is claimed that in passing through the glassware the light loses very little of its illuminating power, and is not coloured in the slightest degree. A large variety of table standards, &c., together with an instantaneous electric water-heater are also to be seen.

Messrs. Alloy Welding Processes, Ltd., London, exhibit samples of structural steel work, in which the joints are welded instead of being riveted, as is usual practice. Samples of tramway rail welding and other work carried out by the A.W.P. process, and different types of electrodes, are also on view.

Emigration of Workmen from U.S.A.—Recent reports show that workers are leaving the United States at the rate of 1,000 a day. Most of them that emigrate will not come back, and few will come to replace them. Wholesale emigration of this kind will harm industry, lessen production. The electrical industry will suffer in proportion to the others. But this very thing, in a way, may prove helpful to the industry, as it will result in renewed activity in search for, and invention of, labour-saving devices, and in new applications of the use of electrical energy. Developments during the war period proved that electricity, through its numerous applications, replaced in some measure the loss of man-power in the industrial world. It did it then, and it can do it now if a real shortage of man-power results from the heavy tide of emigration. *Electrical Review*, Chicago.

THE CURRENT TRANSFORMER.

By C. W. MARSHALL, B.Sc.

The following is an outline of the principal characteristics of current transformers used for operating alternating-current instruments, such as relays, ammeters, and watt-meters. The subject is dealt with from the standpoint of the user.

Engineers responsible for the constructional side of switchboard work generally look on instrument transformers as a necessary evil, and their requirements are that the primary windings should have as few turns as possible, and that the sectional area of copper and the insulation used should be very liberal. In many cases it is specified that single-bar primaries only are allowable. The reason for this attitude is that transformers with multiple-turn primaries are liable to break down between turns in the case of potential surges, and to act as fuses during the enormous rushes of current which pass through them when faults occur. These points are specially important on systems of large K.V.A. capacity, and the only note that need be made on them is that, although the secondary winding is almost as important as the primary, it is very seldom mentioned in specifications. On low-tension systems, open-type transformers are used; but on high-tension systems they must be enclosed and insulated with oil or "compound." The latter type is much superior, as it requires less supervision and is far easier to keep clean.

FIG. 1.—GENERAL DIAGRAM. FIG. 2.—DIAGRAM FOR NON-INDUCTIVE LOADS.
Vector Diagrams for Current Transformer.

The testing engineer for whom accuracy is the essential point wants a transformer in which the secondary current is an exact reproduction on a reduced scale of the primary current. It is a fairly easy matter to fulfil this requirement so far as numerical ratio is concerned, and at the same time to satisfy the constructional features mentioned above. To be a true reproduction, however, it is necessary that the reversed secondary current should be exactly in phase with the primary, and this can only be the case when there are many primary ampere-turns.

As the importance of this aspect of the subject is extremely great, an outline of the elementary features of the current transformer will not be out of place, although it has already been exhaustively dealt with.

In fig. 1 the notation is as below :—

I_1—Primary current, n = turn ratio. (Secondary turns ÷ primary turns).
I_2—Secondary current.
I_m—Magnetising current.
E_2—Secondary induced E.M.F.
I_2—Secondary terminal E.M.F.
ϕ—Phase angle of transformer.

The essential purpose of the diagram is to show what determines the transformation ratio I_1/I_2 and the phase angle ϕ (the angle between the primary and reversed secondary current vectors). The diagram is drawn in the following steps :—

1. Draw O E_{2t} to represent the secondary terminal voltage = secondary current (I_2) × secondary load impedance.

2. Draw O I_2 to represent the secondary current in magnitude and direction.

3. Draw E_{2t} E_2 parallel to I_2, representing the voltage drop in the secondary winding. This gives O E_2 the secondary induced E.M.F.

4. O F perpendicular to O E_2 through O represents the flux in the core of the transformer.

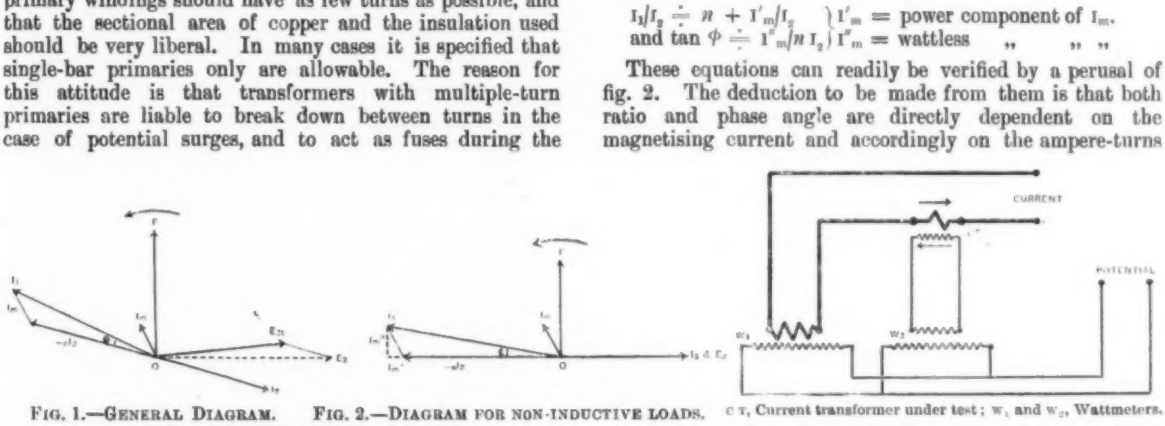
5. O I_m drawn slightly in advance of the flux vector represents the magnetising current.

6. $n\,I_2 + I_m$ gives O I_1 the primary current.

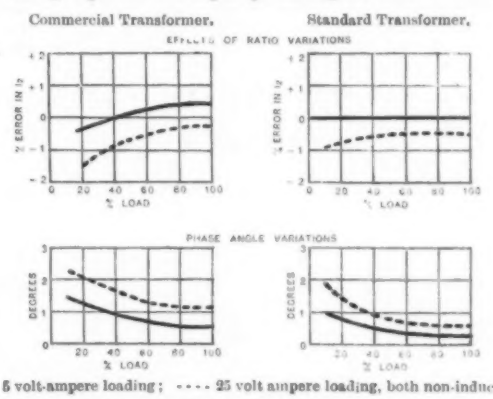
The load on the secondary is generally almost non-inductive, and the ratio and phase angle may be approximately determined from—

$$I_1/I_2 \doteq n + I'_m/I_2 \quad \left.\right\} I'_m = \text{power component of } I_m.$$
$$\text{and } \tan\phi \doteq I''_m/n\,I_2 \quad \left.\right\} I''_m = \text{wattless} \quad " \quad "$$

These equations can readily be verified by a perusal of fig. 2. The deduction to be made from them is that both ratio and phase angle are directly dependent on the magnetising current and accordingly on the ampere-turns of the windings. It is also clear from the diagrams that the reversed secondary current is in advance of the primary current by a small angle referred to above as the "phase angle of the transformer." The importance of this angle lies in its effect on the indications of power and energy meters used in conjunction with transformers. On lagging loads the effect of the phase angle error is to increase the instrument reading and on leading loads the converse holds. To give readers an idea of the numerical values of the ratio and phase angle variations with different types of transformers graphs have been drawn, showing the variations of these for two transformers, one being of very high quality, while the other is of the ordinary commercial grade. These are shown in fig. 4. Instead of plotting ratios directly, it was thought preferable to plot percentage errors in secondary current, so that a positive error should mean that the connected instrument would read high. It will be noted that the ratio of the standard transformer with a load of 5 volt-amperes was constant within 1/1000 from full load to tenth load current.



C T, Current transformer under test; W_1 and W_2, Wattmeters.
FIG. 3.—TEST TO ILLUSTRATE EFFECTS OF PHASE ANGLE.



—— 5 volt-ampere loading; - - - - 25 volt ampere loading, both non-inductive.
FIG. 4.—COMPARISON BETWEEN CURRENT TRANSFORMERS.

A simple experiment, which shows the great importance of "phase angle" in power measurement, consists in making a comparison between the readings of a good total current wattmeter and one whose current coil is supplied from a current transformer (preferably one with bad phase-angle characteristics). The scheme of connections is shown in fig. 3. The current and potential circuits are supplied from

separate sources which can be varied in phase with respect to each other. If the volt-ampere load on the two wattmeters is kept constant, and if their readings are varied by changing the phase relationship between the current and potential, the effect of the current transformer phase angle will be shown very clearly. Fig. 5 shows the results of such a test on a 500/5 current transformer, with a bar type primary. It will be seen that on low power factors, the errors are very large, and that under ordinary conditions (lagging loads) they will be positive, *i.e.*, the wattmeter connected to the transformer will read high. The ratio of the transformer tested was almost exactly correct at 5 V.A. load, and was approximately 2 per cent. wrong (secondary

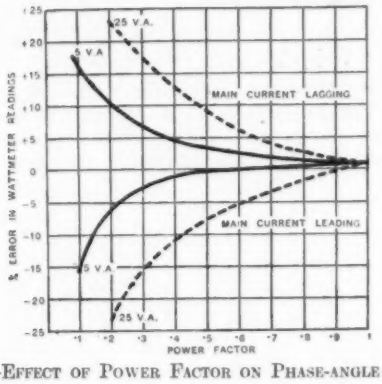


Fig. 5.—Effect of Power Factor on Phase-angle Errors.

current low) at 25 V.A., hence it may be said that ratio tests by ammeters are almost valueless.

The final message of these notes is to emphasise the fact that phase-angle is of vital importance in power and energy measurements, and that ratio tests should be made by means of wattmeters rather than ammeters. This, of course, is well known to all engineers engaged in instrument testing on a large scale, but it is hoped that the information given may be useful to others less fortunately placed as regards testing equipment. It may also help to persuade the few reactionary managers who remain, that it is in their own interests to provide sound testing apparatus for their assistants. Those who wish to pursue the subject further will find the following articles of interest:—

1. Instrument Transformers. Chapter XII of "Electrical Measurements," by F. A. Laws.

2. A Study of the Current Transformer. P. G. Agnew. Reprint No. 164. *Bulletin* of the Bureau of Standards.

3. The Selection of Current Transformers. N. W. Lofvengren. *British Westinghouse Gazette*. Vol. III, p. 584.

Nos. 1 and 2 treat the subject in detail, and give extensive bibliographies.

No. 3 is extremely readable, and is strongly recommended.

THE INTERNATIONAL ELECTROTECHNICAL COMMISSION.

As mentioned in our last issue, meetings of the Advisory Committees of the I.E.C. were held in Brussels from March 27th to 31st inclusive.

In addition to the secretaries, about 35 delegates were present from eight different countries, the British representatives being: Major K. Edgcumbe, Messrs. A. R. Everest, A. J. Stubbs, C. Rodgers, W. B. Woodhouse, C. H. Wordingham, C.B.E., and C. C. Wharton.

Rating.—The first volume of the I.E.C. Rating Rules for electrical machinery for machines not exceeding 5,000 volts, 750 K.V.A. rated output, and 50 cm. in length axially, had been previously approved for issue; this meeting therefore devoted most of its time to the consideration of questions which would apply to larger machines. It was agreed to recommend that the dielectric tests given for small machines should apply also to large machines, with the exception of turbo-alternators. With regard to the latter, the French Committee's proposals that the high-voltage tests should be increased were referred to the National Committees for consideration. The use of embedded temperature detectors for the acceptance tests of electrical machinery was again discussed; and whilst it was generally agreed that these should be used in the case of large machines, there was still a very considerable difference of opinion as to the limit above which the use of this method of measurement should be compulsory, and the question will need further consideration. The American Committee recommended the use of embedded temperature detectors for all rotating machines larger than those dealt with in Vol. 1 of the I.E.C. rules, whereas the British Committee proposed their compulsory use for acceptance tests only for turbo-generators and similar machines over 5,000 K.V.A., whatever the voltage and core length, and for other rotating machines over 90 cm. core length, whatever the K.V.A. and voltage, or over 65 cm. core length, if over 6,000 volts, whatever the K.V.A. With regard to the terminal markings given in appendix 1 of the I.E.C. rules, it was not agreed to recommend these for adoption, as the American Committee pointed out that it was undesirable to fix terminal markings for transformers until terminal markings for motor and control apparatus had been settled; the American Committee was invited to forward a specific recommendation on this point.

Graphical Symbols.—The British delegates submitted the British list of graphical symbols which had been prepared, but not yet issued. This list had been based on the proposals received from the Italian National Committee, the B.E.A.M.A., and many other sources, and many of them were adopted for recommendation to the National Committees for acceptance internationally.

Nomenclature.—The work on nomenclature which had been suspended during the war was commenced. The general principles upon which the work should be developed were discussed, and it was decided to prepare an international electrotechnical vocabulary taking into consideration all the existing national vocabularies, each National Committee to add a translation of the definitions in its own language in a national edition. The vocabulary should be compiled so as to include a definition of the word in English and French, and in such a way that there would be no difficulty in finding, either in the vocabulary or in an appendix, the equivalent words in the various other languages. It was felt that it would not be possible in the official publications to extend beyond the official languages of the I.E.C., namely, English and French. In order to hasten the work, a sub-committee was appointed consisting of one delegate from each of eight countries, and a meeting of this sub-committee is to be held at Zurich in June.

A recommendation proposed by M. Paul Janet was accepted for reference to the National Committees, to the effect that it was very desirable that the National Committees should exercise in their respective countries a moral influence to prevent or to stop the formulation of electrotechnical terms, definitions, and symbols which would ultimately present a serious obstacle to international agreement.

Standard Pressures.—The Advisory Committee on Standard Pressures for Insulators considered various proposals which had been submitted by the National Committees, and finally formulated a series of standard high pressures together with the proposals for the high-pressure test in each case. These proposals will be submitted to the various National Committees for their consideration.

It is proposed to hold the next meeting of these committees in Paris in November.

A report of each of the meetings, giving the proposals in detail, will be available very shortly.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Chelmsford Street Lighting Contract.

As the Press has drawn attention to the fact that Chelmsford has decided to revert to the use of gas for street lighting of the borough, I would ask you to publish this letter explaining our view of the case.

The streets of Chelmsford have been lighted by electricity for over 30 years. It has been stated that Chelmsford was the first town in the United Kingdom to use electricity exclusively for street lighting. My recollection of the matter is that Fareham was lighted in this way a few months before Chelmsford. There is no doubt, however, that Chelmsford was one of the pioneers, and it has always maintained its position in the electrical world. The old-established firm of Crompton & Co. is still pre-eminent in the manufacture of electrical machinery, and in more recent years Marconi's wireless telegraph works have, by their establishment at Chelmsford, associated the town with another branch of the electrical industry.

The contract under which we carried out the street lighting at Chelmsford came to an end on March 31st last, and it was not renewed, as our tender for a new contract was not accepted.

In 1914 the main street of the town was lighted by flame arc lamps, the other streets by means of 100-C.P. incandescent lamps except for a few which were lighted by gas.

Our tender which was refused provided that we should light the main street by means of ¼-watt lamps taking the same amount of energy as the pre-war arc lamps, and for this

we tendered the pre-war price. For the other streets we tendered at an increase of 59 per cent., *i.e.*, £5 instead of 3 guineas per lamp per annum. These prices are, surely, a moderate increase in view of the changed circumstances with regard to the cost of material and labour.

We have not been told why our tender was refused, but we understand that the gas lighting scheme shows a saving on the rates we put forward.

The Chelmsford Gas Co. was some years ago taken over by the Chelmsford Corporation, and the rate of 3s. 5d. per 1,000 cu. ft. charged by the Gas Co. in 1914 has now been increased to 5s. 7d., an increase of 64 per cent.

In the past we secured the street lighting in competition with gas; it would appear, therefore, that it is proposed to provide gas for street lighting purposes much below the present price to the general public; moreover, it will, of course, be necessary to provide gas lighting equipment for all the streets, and at present prices.

We can quite understand that having acquired the gas works the Corporation of Chelmsford is desirous of providing its own street lighting, but would like to take this opportunity of pointing out that its decision cannot have been influenced by any unreasonable demand on our part.

K. Moncrieff,
Managing Director,
The Electric Supply Corporation, Ltd.

London, E.C.
April 17th, 1920.

Electrical Appliances in Bathrooms.

With reference to your article in the Electrical Review of the 16th inst., is it not a fact that *switches* in bathrooms are the most frequent cause of electric shocks? If contractors would only use a high-grade rotary switch, all-china switch with china dolly, or, as an alternative, place all switches at about ceiling level controlled by strings, this would avoid trouble and would not unduly increase the cost of installation. For wiring I favour lead-covered cable and sealing-in boxes.

Electrician.

April 14th, 1920.

Capitalists All.

Your interesting article boiled down means what has often been suggested before, viz., that workmen shall share in the profits as they increase, as the shareholders do. Good. But what about when the profits decrease?

F. Perceval.

Manchester, *April 13th*, 1920.

[It is not our article. The author deals with the point in the concluding instalment to-day.—Eds. Elec. Rev.]

Electric Japanning Ovens.

I was much interested in reading your notes re electric japanning ovens. Perhaps you would consider the following experience with electric stoving of equal importance to your readers, and worthy of space in your next issue.

It is over eight years since my employers installed a battery of nine varnish stoves for stoving varnished printed tin sheets. These stoves were heated by gas, and the temperature of each stove was from 180 deg. C. to 290 deg. C., according to the class of work being stoved. The size of each stove is 18 ft. deep, 6 ft. wide, and 6 ft. high.

In 1913 I converted four of these gas stoves for electric stoving, and I am more than satisfied with the results. Since these four stoves were converted I have been able completely to shut down the remaining five gas stoves, and we are able to get through more work, in the same time, with four electric stoves than was possible with the whole nine gas stoves.

Comparing the actual cost of electricity against gas, we find that the cost of gas per 1,000 sheets stoved is 10 per cent. less than that of electricity. The advantages of electric stoving are chiefly:—

Greatly increased output.
No fear of explosion.
Easy to control.
Purer atmosphere, and
Much better work turned out.

There may be other users of electricity in this country for the same class of work, but I have not up to the present heard of any.

Alfred Rider, A.M.I.E.E.

Hull,
April 15th, 1920.

The Commercial Efficiency of Fuel.

I am somewhat surprised that you repeat your statement that in the discussion in Birmingham the case of electricity was not adequately presented, in view of my pointing out that the report on which you admittedly based your conclusions is an imperfect one.

It was not possible, I think, for an adequate report to be put in the Press unless very much more space had been given. For example, I myself spoke, I believe, for as long as any of the other speakers, and yet the report of my remarks was suppressed altogether. This is probably my own fault, as owing to pressure of work I did not prepare a typewritten copy of my speech, and I do not make any complaint about it not being reported, but I certainly feel that the other speakers and I have a just cause for complaint of your action in making the statements you have without being fully informed of what took place on the occasion of the debate in question.

C. C. Garrard.
Chairman of the South Midland Territorial Centre of the Institution of Electrical Engineers.

Witton, Birmingham.
April 10th, 1920.

[So far as opinion is concerned, we are entitled, and are able, to form our own opinion without assistance. But Dr. Garrard assures us that we are not in possession of the facts, and that the report, though provided by the authorised reporter, and said to have been revised by the speakers, was far from representing the discussion. Very well, then; it is obviously common ground, that *the report of the discussion does not adequately present the case for electricity*. We accept that position, and the speakers leave the court without a stain on their character.—Eds. Elec. Rev.]

Illicit Commission.

It is an unfortunate fact that the electrical trade is none too free of underhand methods, but it is not often that one has experience of so gross a misdemeanour as the following letter, which is dated from Walsall, and addressed to this firm:—

Walsall,
April 15th, 1920.

Dear Sirs,

I beg to ask you if you will let me know what commission you will let me have on all orders for switch gear.

The orders would be for single, double, and triple pole switches ranging from 30 to 150 amperes. Now, if you like I will have the orders sent to you by a firm in this town. I can assure you they will open an account with you if I ask them, for I am in charge of their large electric plant. We are always in want of switches, and I had six of your single-pole switches two years ago, but through another firm, and I may say they have been exceedingly good ones.

My firm need not know that you would give me commission. I should also be glad if you would send lists of your switches and other electrical goods you supply.

Trusting I shall hear from you and your agreement.

Faithfully yours,

X. X. Xxxxxxx.

(We refrain from giving the name.)

The Cantie Switch Co., Ltd.

Nottingham.
April 16th, 1920.

[There is a brazen candour about this proposal which compels admiration—but in no way lessens the iniquity of the intention, while it aggravates the insolence of the suggestion that the firm would stoop to such practices. Walsall firms would do well to search out the writer and prosecute him.—Eds. Elec. Rev.]

The Conjoint Board of Scientific Societies.—The annual report for 1919 states that four societies were admitted to membership, the Royal Statistical Society, the Röntgen Society, the Illuminating Engineering Society, and the Surveyors' Institution, bringing the total number of constituent bodies up to 57. Three ordinary meetings were held, and also a special meeting to consider the reports of the Committees on the Metric System and the Patent Laws. The Committee on Water Power, under the chairmanship of Sir Dugald Clerk, K.B.E., F.R.S., claim to have stimulated considerable interest in the subject, and that steps are being taken in many parts of the Empire to survey water resources for the development of electricity. The report states that "During the year a number of applications for advice or assistance have reached the committee from various Colonial Governments interested in the development of their hydraulic resources. These have served to strengthen the opinion of the committee, expressed in their first report, that some permanent central body is urgently required to co-ordinate, advise, collect, and distribute data relating to water powers throughout the Empire. In view of this opinion, the committee welcome the suggestion to hold an Imperial Conference on Water Powers in London during the present summer." An elaborate report on the advisability or otherwise of the compulsory adoption of the metric system, dealing boldly with the actual practical difficulties confronting the scheme, will be published shortly, together with the criticisms of the various scientific and technical societies to which it has been submitted.

LEGAL.

Factory Act Prosecution.

At Spennymoor (County Durham) Petty Sessions, on April 13th, Messrs. Coulson & Co., Merrington Lane Ironworks, Spennymoor, were charged under the Factory and Workshop Act with having neglected to sufficiently earth electric wires used in connection with a portable drilling machine.

Mr. W. Lauder, factory inspector, who prosecuted, stated that Joseph Richardson, an employé of the defendant firm, received a severe electric shock whilst attending to the machine in question, and as a result had been unable for a month to follow his employment. The regulations specified that the machine should have been sufficiently earthed so as to make it impossible for any workman to incur risk from the electric current. Richardson sustained a shock at 230 volts.

In the witness-box, Richardson said he was knocked over and injured while attempting to get hold of the machine handle.

Mr. Proud, for the defence, contended that there had been no wilful neglect, the firm invariably complying with the recommendations of inspectors.

After a long consultation in private the Bench decided to dismiss the case on payment of costs.

It was stated there would be an appeal against the decision.

Can Special Specifications be Charged For?

In the City of London Court, on April 13th, before Assistant Judge Jackson, Mr. Reginald Williams, trading as "Y" Electrical Installation Co., 4, Creechurch Lane, E.C., sued the Paddington Radical Working Men's Club, Ltd., for 10 guineas for services rendered with reference to the electrical installation at their premises. Mr. Scott Duckers appeared for the defendants.

Plaintiff said that the club had got out a specification for lighting the place with ordinary drop lights. He thought a special ceiling bowl fitting, if utilised, would cast a reflected light from the ceiling and give much more light. That would naturally save current. The secretary suggested that he (plaintiff) should give the club a special estimate based on his idea of the reflected light. The secretary took him round to the club, and witness pointed out to the secretary where, in his view, the particular lights should be placed. At the same time he pointed out the points that had been specified in the specification. The secretary was convinced that the lights proposed by witness would be more effective and that fewer points would be required. Consequently, less current would be consumed. The secretary asked him to give the club a special specification, and at the same time to specify the cost in accordance with the club's own specification. Accordingly he sent the club two specifications, and the special specification took a long time to get out, and involved expense in production. The club decided to adopt their original specification, notwithstanding the fact that they had asked him for his suggestions in writing. He went to no end of trouble in the matter, and went over the club premises three times. At last he sent a telegram quoting for their own specification. They did not even acknowledge his estimates, and they ultimately turned him down altogether. He now claimed the very moderate fee of 10 guineas for loss of time and professional services in the matter.

Frederick Samuel Morris, secretary of the club, was called. He said that on October 28th the committee decided to have some fresh lighting arrangements, and a rough specification was drawn up with a view to the club being electrically lighted. They posted up a notice on the club's notice board to the effect that tenders would be invited, and as a result of that they received tenders from five firms. The plaintiff was one who tendered in common with others. He was not asked to effect any improvement in the club's specification, nor was he asked to do anything more than each of the other firms who tendered for the work was willing to do. He did not employ plaintiff professionally to evolve any new scheme of lighting. Witness had no power to pledge the club's credit, nor did he in fact do so. The tenders were examined by the club's committee, and the tender of Mr. McLelland, who did the work, was accepted. Then he received a telegram from the plaintiff making a further quotation, but the matter having been settled there was no reply.

The Assistant Judge was fully satisfied that the plaintiff tendered in the same way as the others, and that he had made some suggestions which, if they had been adopted, might have improved the light or not, but that was done on plaintiff's own account. The plaintiff's tender was not accepted, and he was clearly of opinion that the plaintiff had no legal claim. Judgment for defendants with costs.

Rist v. Vulco Magneto Co.

A partnership purchase of Government magnetos gave rise to an action heard by Sir F. Newbold, the newly-appointed High Court Official Referee, on the 13th, 14th and 15th April, in which Mr. D. V. A. Rist, trading as the Vulco Manufacturing Co., claimed from the Vulco Magneto Co. and Mr. H. Rothwell the delivery of 90 magnetos or their value, and damages. The original claim was for the delivery of 140 magnetos, but by order of Mr. Justice McCardie 50 of that number had been delivered.

Mr. Arthur Lawton appeared for the plaintiff, and Mr Cartwright Sharp represented the defendants.

It appeared that in 1917 the Government desired to sell a number of magnetos stored at the White City which had belonged to the R.A.F. Mr. Rist tendered for them, and his tender was accepted. For the purpose of carrying out the purchase he entered into partnership with Mr. H. Rothwell under the title of the Vulco Magneto Co., and that partnership continued from December 17th, 1917, until November 20th, 1918, at which latter date it was dissolved, and the business of the defendant firm was afterwards carried on by Rothwell in partnership with one S. J. Watson. In October, 1918, the defendant firm assigned to the plaintiff £220, the whole of their stock of the B.T.H. (British Thomson-Houston), T.B. (Thomson Bennett), and D.U.5 (Bosch) magnetos, being 190 in number, comprising 100 D.U.5, 23 T.B., and 17 B.T.H., with a further 23 T.B. and 17 B.T.H. The consideration for the sale was met by a reduction *pro tanto* of a debt then owing by the defendant firm to the plaintiff. On the same date the plaintiff assigned to the defendant Rothwell for the sum of £110 90 of the magnetos. It was alleged that the defendant had not completed the transaction, and that he had wrongfully detained certain of the magnetos. It was a term of the sales that Rothwell should deliver to the plaintiff within reasonable time, but it was alleged that he had failed to do so, and a claim of some £600 was made for non-delivery, with damages for detention.

The defendant denied liability, alleging that it was a matter of account and counter-claiming against the plaintiff for breach of contract. There was also a minor claim by the defendant Rothwell for small sums relating to the partnership prior to the dissolution amounting in the aggregate to £56.

After several witnesses had been heard, the Official Referee offered a suggestion as to the nature of the matters in dispute, and the desirability of the parties considering whether under the circumstances a settlement could not be arrived at.

With this end in view the parties agreed to an adjournment of the action for three months.

Harvey v. London Electric Railway Co.

In the King's Bench Division, on April 19th, Mr. Justice Roche heard an action brought by Mrs. Kate Harvey, a widow, against defendants to recover damages for personal injuries sustained by her whilst attempting to board a train at Baron's Court Station on the Piccadilly Railway, on January 8th, 1919.

Evidence was given for the defence that the plaintiff attempted to board the train when the gates had been closed and the train had begun to move.

His Lordship said he accepted the evidence of the plaintiff that the gates were not closed when she attempted to board the train, and that the train was started when the gates were sufficiently open to constitute an invitation to the plaintiff to follow her daughter into the train. He therefore found there was negligence on the part of the company's servant. Judgment was given for the plaintiff, the damages being assessed at £275, with costs.

Bennett v. A.A. Electrical Co., Ltd.

In the King's Bench Division, on April 15th, Mr. Justice Rowlatt sitting without a jury had before him an action which raised certain complicated issues as to electrical goods seized by the sheriff, and as to money garnisheed. The action was brought by a Mr. Bennett against defendant company, of Farringdon Road, E.C.

In giving judgment, his Lordship said the two interpleaders included goods taken in execution, and the other affected a sum of money garnisheed, and the question was whether the execution debtor had not assigned both goods and money to the plaintiff in the interpleader issue. Documents had now been produced by which the assignment was clearly made on March 27th, 1919, and what the defendants' execution creditors had to make out was that those documents were not intended between the parties to have any operation at all, so that not only did nothing pass at the time, but that the business had ever since been carried on as the business of the execution debtor, or at any rate the business of somebody not the plaintiff under the interpleader assignee, because the goods which had been seized and the money garnisheed were not the original subjects of the assignment, and were the assets and money of the business as it existed some six months later at the date of the execution and the garnishee proceedings. It was an issue which required a good deal of proof on the part of the defendant. It required a good deal of evidence to make one come to the conclusion that the whole thing was a sham, and that the business had not become the property of the plaintiff. He could not say the position of this business and these assignments was at all clear. In fact, he was not certain he had been told all about it, or that he knew exactly what the position was. The

business was carried on in a very odd and informal and elementary way in several respects. In the first place, the business of Williams, the assignor, was very largely in the hands of a manager. He seemed to be a man who knew rather more about the business than Mr. Williams himself. He guaranteed the purchase, and even guaranteed the banking account, and when the assignment was executed he remained on as manager under the assignee. He had some business interest as a creditor in it, and he was to receive a considerable portion of the moneys from the assigned. It might be that he continued on in the service of the assignee in order that he might see that the business earned what he was going to get out of the assignment. With regard to the transfer of the assets, it was clear that there were a number of lighting accessories, largely including batteries, but the assignee never seemed to have had any proper valuation made, but judged what he thought they were worth in a rough-and-ready sort of way. There was no evidence that the assignor had ever had any beneficial interest in what was to be made out of it in a business sense. He had to be paid certain sums, but they were fixed sums provided for, and there was no hint that he had received any sum which corresponded with that which was actually made out of the business. He could not maintain the defendants' position in this interpleader, as he (his Lordship) felt he had not got to the bottom of the transaction. Under the circumstances he must hold that the plaintiff succeeded in both the interpleaders, and must give judgment for him with costs.

Lindsell *v.* Paignton Electric Light Co., Ltd.

Mr. Justice Bailhache, on April 13th, delivered the judgment of the Divisional Court of the King's Bench in the case of Lindsell *v.* Paignton Electric Light Co., Ltd., heard on January 23rd, which was an appeal from the judgment of the County Court Judge of Paignton, raising the question whether electricity supplied to a kinema could be charged for as for power or as for lighting purposes.

Mr. Justice Bailhache, in giving judgment, said the question to be decided is whether certain electrical energy supplied to the respondent is to be charged at the lower rate, as he contends, or at the higher rate, as the appellants contend. The learned judge has decided in favour of the respondent.

The electrical energy in question is used except as to a small part of it for making light in the arc lantern, and the dispute as between the parties has arisen because the electrical energy so used passes through a transformer or rotary converter. The transformer receives the energy at a pressure of 440 volts, and passes it out to the arc lamp at a pressure of 60 volts. No new energy is created. The same energy that is supplied by the appellants from their generating station reaches the arc lamp, but at a reduced pressure. The appellants, therefore, supply electricity for the defendant's arc lamp. Is the electricity used for light or for power? I think for light. The learned judge has found otherwise. The contract is, I think, plain enough, although there may be room for doubt in a given case whether in point of fact energy supplied is used for light or for power. He further seems to restrict the word lighting to such light as would enable the respondent to pursue the ordinary habits and purposes of life. I must respectfully differ. The light used in showing films can only, I think, be described as light, and is not the less light than the light of a reading lamp. The chief reason for the decision of the judge below was, I think, to be found in the sentence "one must look at the primary use of the introduction of the energy to the machine, and not to the ultimate result, to see to which of the two objects the energy was supplied within the meaning of the contract." It seems to me that the fact that the energy passes through the transformer, and in so doing causes part of its mechanism to rotate, does not affect the question. The energy is not supplied for the purpose. It is supplied for light, and is used for light. As I have said, the energy which leaves the generating station is intended to reach and does reach the illuminating apparatus, although at a lower pressure. A small portion of the electricity supplied is used for operating the film-driving motors. This is clearly used for power, and is only chargeable at the power rate. The rest and by far the largest amount must be paid for at the lighting rate. The parties can no doubt agree the relative proportions. In my opinion the appeal must be allowed with costs.

Mr. Justice Bray concurred, and the appeal was accordingly allowed.

BUSINESS NOTES.

Exports and Imports of Electrical Goods for March, 1920.—The returns of electrical exports for the month of March show an all-round improvement as compared with the previous month, the export values reaching £1,102,781, as compared with £761,973 in February, 1920, with £420,452 in March, 1919, and £992,681 in March, 1913; the 1913 total including a large telegraphic export to Ceylon, valued at £450,000, the 1920 export total also including telegraphic and telephone cables and materials to the value of £464,000. The total weight of electrical machinery exported amounted to 695 tons, as against 569 in March, 1919, and 2,007 for March, 1913.

The electrical import totals for the past month were £136,310, as against £188,026 for the previous month of February, the principal falling off occurring in electrical machinery, £30,000, and telegraph and telephone cables and apparatus, £10,000. The re-exports of foreign and Colonial electrical material vary very slightly, the March total being £10,114, as against £9,798 for February.

Values of Electrical Exports and Imports for March, 1920.

	Exports.	Imports.	Re-exports.
Electrical goods and apparatus (unenumerated)	£131,084	£37,720	£2,308
Insulated wire	254,077	5,178	—
Glow lamps	18,174	3,643	2,576
Arc lamps and parts	4,352	1,353	—
Batteries...	37,775	8,753	—
Meters	29,998	4,781	197
Carbons	5,438	9,841	—
Electrical machinery :—			
Railway and tramway motors...	1,686	—	—
Motors and generators	84,398	—	—
Elec. machinery (unenumerated)	64,307	57,482	3,846
Switchboards (not telegraph or telephone)	7,460	—	183
Telegraph and telephone cables and apparatus :—			
Telegraph and telephone wires and cables (not submarine)...	45,821	184	—
Submarine telegraph and telephone cables	303,406	50	—
Telegraph and telephone instruments and apparatus ...	114,805	7,325	1,004
	£1,102,781	£136,310	£10,114

New Belgian Company.—La Société Indépendante Belge de Télégraphie Sans Fil is the name of a new company which has just been formed in Brussels, with a capital of 1,000,000 fr., in connection with wireless telegraphy and telephony, and to enter into a contract with the Société Indépendante de Télégraphie Sans Fil, of Paris.

Winnipeg.—The Winnipeg Board of Trade has issued some interesting publicity literature respecting the vast electric power resources of the City, and the importance and merits of the place as an industrial centre.

Electric Vehicles in Milan.—A company has just been formed in Milan, with the title of La Società Italiana dei Veicole Elettrica, to inaugurate a service of electrical motor vehicles in that city. The cars to be employed are to be imported from America.

Whitley Council.—District Council (No. 1) North-East Coast Area Electricity Supply Industry.—This Council has been constituted as follows :—

Employers' Representatives.—Mr. E. B. Barlow, A.M.I.E.E., engineer and manager, Berwick Electric Lighting Co.; Mr. J. Cusworth, operation engineer, Cleveland and Durham Electric Power, Ltd.; Mr. E. Hatton, general manager, Newcastle Corporation Tramways; Mr. J. R. P. Lunn, M.I.E.E., electrical engineer, Darlington Corporation; Mr. E. Moxon, A.M.I.E.E., electrical engineer, South Shields Corporation; Mr. R. H. Scotson, electrical engineer, Middlesbrough Corporation; Mr. R. P. Sloan, C.B.E., M.I.E.E., manager and director, Newcastle-upon-Tyne Electric Supply Co.; Mr. J. W. Spark, electrical engineer, West Hartlepool Corporation; Mr. N. S. Tennant, M.Sc., general manager and engineer, Newcastle and District Electric Lighting Co.; Mr. C. Vernier, M.I.E.E., mains engineer, Cleveland and Durham Electric Power, Ltd. (auditor); Mr. J. S. Watson, technical manager, Newcastle-upon-Tyne Electric Supply Co. (chairman); Mr. A. Wood, director, Newcastle and District Electric Lighting Co.

Trade Unions' Representatives.—Mr. T. Bowmaker, Amalgamated Society of Engineers; Mr. J. Cassidy, National Amalgamated Union of Labour; Mr. J. Egerton, Amalgamated Society Toolmakers, Engineers and Machinists; Mr. A. Ford, United Machine Workers Association; Mr. J. Gibson, Amalgamated Society of Engineers; Mr. H. Lynas, National Union of General Workers (auditor); Mr. G. A. Olley, Electrical Trades Union (vice-chairman); Mr. W. C. Percival, Steam Engine-Makers' Society (secretary); Mr. T. Reed, National Amalgamated Union of Labour; Mr. G. C. Richardson, Steam Engine-Makers' Society; Mr. E. Robinson, Electrical Trades Union; Mr. W. Sherwood, National Union of General Workers.

Employers' Secretary.—Mr. A. A. Dunn.

A Hungarian Company.—The Hungarian Felten and Guilleaume A.G., of Pesth, proposes to pay a dividend of 15 per cent. for 1919, as in the previous years. The directors state that a very considerable stock of orders has been brought over into the new financial year, although the difficulties experienced in obtaining raw materials, which have to be procured from abroad and paid for in foreign currency, are greater. It has been decided to increase the share capital from 3,000,000 kr. to 5,000,000 kr., so as to be able to take up new branches of manufacture.

Applications for British Trade-marks.—Appended is a summary of the recent applications for British trademarks in respect of goods connected with the electrical trades and industries :—

Nife (letters combined with design). No. 393,429. Class 8. Electric lamps and lanterns. Batteries, Ltd., 19, Coleman Street, London, E.C. July 18th, 1919.

Nife Accumulator (letters combined with design). No. 393,430. Class 8. Electrical accumulators. Batteries, Ltd., 19, Coleman Street, London, E C.

Lewcos. No. 395,075. Class 40. Wire, insulated, coated with india-rubber. London Electric Wire Co., and Smiths, Ltd., 7, Playhouse Yard, Golden Lane, London, E. September 9th, 1919.

Siddor. No. 398,519. Class 13. Electrically-heated ignition plugs, soldering-irons and metal utensils. Charles H. Reddis, 66, Elstow Road, Bedford.

Graham (lettering combined with design). No. 398,084. Class 13. Electric bells, diaphragm horns for motors, &c. Edward A. Graham, trading as Alfred Graham & Co., St. Andrews Works, Crofton Park, London, S.E. December 5th, 1919.

Dielex. No. 399,711. Class 50. Electrical insulators. J. J. Eastwick & Sons, 3, Belfast Road, Stoke Newington, N. 16. January 19th, 1920.

Areco. No. 400,169. Class 18. Electric fires, heaters and stoves. Anglo-Russian Engineering Co., Ltd., 374-378, Old Street, London, E.C. January 29th, 1920.

Homo. No. 399,679. Class 18. Electric lighting plants. Tattersalls, Ltd., 4, Great Marlborough Street, London, W. January 7th, 1920.

Spitfire. No. 400,517. Sparking plugs and metal goods in Class 13. Frederick A. Greensmith, trading as the Vital Motor Units Co., Tyler Street, Trafalgar Road, Greenwich, S.E. February 7th, 1920.

Simfix. No. 399,788. Electrical goods included in Class 13. Witchell's Electrical Accessories, Ltd., Endwell Works, Endwell Road, Brockley, S.E. January 21st, 1920.

Simplete. No. 399,789. Electrical goods included in Class 13. Witchell's Electrical Accessories, Ltd., Endwell Works, Endwell Road, Brockley, S.E. January 21st, 1920.

Simpact. No. 399,790. Electrical goods included in Class 13. Witchell's Electrical Accessories, Ltd., Endwell Works, Endwell Road, Brockley, S.E. January 21st, 1920.

Hercules (lettering combined with design). No. 389,974. Class 13. Sparking plugs. Eclipse Manufacturing Co., 424, North Meridian Street, Indianapolis, Ind., U.S.A. April 8th, 1919.

Nichro. No. 396,543. Class 13. Electric cooking and heating appliances. Harry Cheshire, trading as Cranmer & Cheshire, 9, Stewart Street, Spring Hill, Birmingham. October 28th, 1919.

Planet. No. 398,389. Class 13. Sparking plugs for internal combustion engines. Arthur T. Ellis and Harry A. Hands, 129, Castelnau, Barnes, S.W. December 13th, 1919.

Elfa (lettering combined with design). No. 399,863. Class 8. Electrical batteries (not medical), heating elements (being electrical resistances), and electric lamps (philosophical). Arthur Kupper, 62, Noordestraat, Amsterdam, Holland. January 22nd, 1920.

Perna. No. 398,696. All goods in Class 6. The Perna Engineering Works (Blackpool), Ltd., Castlegate, South Shore, Blackpool. December 22nd, 1919.

EElex. No. 399,710. Class 8. Electrical goods and apparatus. J. J. Eastick & Sons, 3, Belfast Road, Stoke Newington, N. January 19th, 1920.

Ediswan. No. 400,157. Machinery and parts of all kinds, included in Class 6. No. 400,159. Class 11. Instruments, apparatus, and contrivances, not medicated, for surgical or curative purposes. No. 400,160. Metal goods in Class 13. No. 400,161. Class 15. Goods of precious metals and imitations thereof. No. 400,162. Class 16. Porcelain or earthenware goods. No. 400,163. Class 18. Engineering, architectural and building contrivances. No. 400,164. Class 32. Silk-covered electrical wire. No. 400,165. Class 40. Goods manufactured from india-rubber and gutta-percha. The Edison-Swan Electric Co., Ltd., 123-125, Queen Victoria Street, London, E.C. January 20th, 1920.

Sollyte. No. 398,050. Class 1. Electrolytes, being chemical substances. Haslam & Stretton, Ltd., 11, Windsor Place, Cardiff. December 4th, 1919.

Foreign Trade.— March Figures.—The following are the values given of electrical goods and machinery in the official returns of imports and exports for March :—

	March, 1920.	*Inc. or dec.*	3 *months*, 1920. *Inc. or dec.*
Imports.	£	£	£
Electrical goods, &c. ...	78,828	— 41,081	— 77,694
Machinery	1,199,539	— 538,978	— 205,964
Exports.			
Electrical goods, &c. ...	952,390	+ 652,514	+1,418,537
Machinery	3,417,192	+1,554,972	+4,887,548

What's in a Name?—The Rio de Janeiro Municipality has decided to impose a tax of 1 conto (about £65) per annum on every plate or sign bearing the designation in a foreign language of any firm or company. It is understood that most of the foreign firms in the city may in consequence change their designations into Portuguese.—*Board of Trade Journal.*

Runcorn Strike Settled.— The Runcorn dockers and watermen who were on strike have returned to work, and the Mersey Power Co. have been again enabled to produce full electrical supplies to the various factories, workshops, and places of amusement in the Widnes and Runcorn district.

French Company Notes.—The Société des Accumulateurs Electriques (A. Denin) is about to increase its capital, which now stands at 3,000,000 fr.

It has been decided to embody the Société Anonyme Westinghouse with the Compagnie Electro-Mecanique, the former company receiving for its assets 20,000 500 fr. fully paid-up shares, and a sum of 1,216,000 fr., payable on June 30th, divided among the shareholders of the Westinghouse Co. *pro rata* with their holding of shares. The Compagnie Electro-Mecanique will also issue 10,000 shares, the subscription to which will be reserved to the shareholders of the liquidating company.

L'Heure Electrique has been established at Paris (92, Rue St. Lazare) for the working of various patents for electric clocks (Mees, Campiche & Verain). The capital is 2,500,000 fr.

Under the name of L'Enterprise Electrique a company has been formed at Paris (13, Rue Dupont-des-Loges), with a capital of 2,000,000 fr.

According to the *Intérêts Economiques*, the Etablissements Maljournal et Baurron are taking a large money share in the Société des Isolants du Rhône, now being formed with a capital of 2,000,000 fr.

Under the style of Le Transformateur has been formed a company at Paris (39, Rue des Acacias), for the manufacture and sale of electrical material, and especially static transformers. Capital, 2,000,000 fr.

Société de Transport d'Energie des Alpes is the name of a company formed at Lyons (49, Rue de la Bourse). Capital, 2,000,000 fr., for the objects indicated in its title. The board of management is made up of leading officials of 10 great Southern companies.

Wages in the Electrical Supply Industry. — At a meeting of District Council (No. 1) North-East Coast Area, held on April 9th, 1920, an application from the Trade Unions to put into operation Industrial Court Award No. 180 was considered, and it was resolved as follows :—

In view of the fact that no standard basic rates had yet been established for the No. 1 North-East Coast Area, the District Council recommends to the National Council that the following increases be paid by the undertakings in the area :—

3s. per week from the beginning of the pay period immediately following March 31st, 1920.

3s. per week from the beginning of the pay period immediately following May 31st, 1920, providing that standard basic rates are not established previous to the latter date.

Italian Company Notes.—There has been formed at Turin the Società anonima Imprese Elettriche Sarde, with a capital of 100,000 lire, for the utilisation of the water resources of Sardinia.

The following companies have augmented their capital :—The Officine Elettromeccaniche Bolognesi, from 500,000 to 1,000,000 lire ; the Società Elettrica Mesagnese di Mesagne ; and the Benigno Crespi (Forze idrauliche di Trezzo d'Adda), Milan, from 9,000,000 to 12,000,000 lire, and also issued bonds to 6,000,000 lire.

L. L. Pinard e Ca is the name of a company launched at Milan (Via Duvini 31) for trade in electrical material and machinery and raw materials. Capital, 25,000 lire.

The Società Italiana Laminazione Alluminio has been established at Alessandria with a capital of 650,000 lire for the rolling of aluminium.

Foccaccia de Castaldo, Fittipaldi e Ca have formed themselves into a company at Naples with a capital of 40,000 lire, for the prosecution of the electro-mechanical industry.

For the construction, taking over, and working of electric plants, the Società Sabina di Elettricità has been established at Rome with a capital of 40,000 lire.

Vaschetta e Labella have been formed into a company at Naples (Via Taraia 58) with a capital of 50,000 lire, for electro-mechanical trading.

A.B.G.D. is the style of a company formed at Milan (Via Bigli 22) with a capital of 600,000 lire, for the working of electro-mechanical patents.

To work the "Fax" accumulator patents in Italy, Scaini, Tronrie e Ca, have been formed into a company at Milan with a capital of 105,000 lire.

The Imprese Elettriche dell'America Latina is a company formed at Milan (Via Borgonuova 3) for the foundation and development of electrical undertakings in Latin America. Its capital is 5,000,000 lire.

Under the style of Società Anonima Monti e Martrini, two firms have joined forces for the manufacture of electrical material, with a capital of 2,000,000 lire. The company's works are at Milan.

The trust, or Consorzio per l'Alienazione degli Impiante e Materiali Elettrici, telegrafici e telefonici residuati della guerra, has been formed at Milan, with a capital of 100,000 lire (to be raised to 5,000,000 lire), to take over war-time electrical plants, &c.

An Indian Ropeway Inquiry.—H.M. Trade Commissioner in India states that the electrical engineer of an Indian municipality is desirous of entering into communication with firms who would be prepared to undertake the construction of a ropeway capable of conveying both goods and passengers over a distance of 10 miles to an altitude of 6,700 ft. (actual rise 4,500 ft.) with a capacity of 10 tons per hour at a rate of 10 miles an hour. For power, it is understood that three-phase, 380 volts, 50 cycles supply is available. The engineer also seeks information relative to electrically-driven rock drills. The address of the engineer referred to may be obtained by interested United Kingdom firms upon application to the D.O.T. Department.

Lead.—In their report dated April 17th, Messrs. James Forster & Co. state :—

On Thursday all markets were more or less affected by the rise in the Bank Rate, and lead did not escape the general depression, July shipment selling down to £41 5s. On yesterday's market further liquidation set in, and prices declined to £37 15s. April, £38 15s. May, £39 5s. June, and £40 5s. July, these being the closing quotations. The Board of Trade returns for March show a balance for home consumption during that month of 6,073 tons, and the figures for the last five months are :—Imports, 43,261 tons ; exports, 30,084 tons, leaving for home consumption 13,177 tons.

Messrs. G. Cawson & Co., writing under the same date, say :—

The market has fluctuated considerably since our report of 10th inst., apparently without any justification since there is really nothing new in the position to warrant any change. . . . There is no doubt that the financial position and the heavy cost of carrying lead is having its influence on operations, and some realisations have taken place as some of them are evidently not disposed to carry lead with the present uncertain outlook. Fresh supplies are not coming in very freely. It is fortunate, perhaps, that this is so, as they are not wanted. There is at present rather more lead about than is required by consumers, and it is very fortunate that the Government are arranging to warehouse some parcels, and are now more ready to meet the wishes of buyers as to deliveries. By doing this they have probably prevented a real débâcle in the market. . . . The supply of lead coming forward is at present ample for all requirements, in addition to the parcels which are being warehoused here privately, and also for account of the Government. The outlook has again become uncertain. The speculative spirit is to some extent broken, and the dubious financial prospects do not encourage fresh operations for an advance in price. We are, therefore, now again inclined to look for quiet markets, and, perhaps, even some further decline.

An Austrian Company.—The report of Felten and Guilleaume A.G., of Vienna, states that it was possible to keep the Vienna works supplied with raw and other materials in 1919, but the Styrian ironworks was at a standstill for some months. As net profits the accounts show the sum of 4,454,000 kr., as compared with 3,993,000 kr. in 1918, and the directors recommend a dividend at the rate of 17 per cent., as in the preceding year. The prospects are regarded favourably in view of the extension of hydro-electric works and the projected conversion of the railways to electric traction.

Catalogues and Lists.—The India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Silvertown, E. 16. Booklet No. 17 (36 pp.).—This is an attractively produced account of the works and products of the company, dealing with various departments, and well illustrated by photographs of the buildings and machinery. The extremely wide field covered by "Silvertown" products is brought to notice effectively. The booklet touches upon dynamos and golf-balls, submarine cables and hot-water bottles.

The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, W.C. 2. List No. 302 (12 pp.).—An illustrated and priced catalogue of tungsten lamps, vacuum and gas filled, carbon filament lamps, automobile lights and flash light bulbs, and the "Ediswan" "Pointolite" lamps.

Welco Patents, 150, Alma Street, Birmingham.—A folder, giving particulars of fixing panels, an electric iron, and the "Welco" combined electric fire and cooking stove, with forms of application for these.

Metrodes, Ltd., 87, Fargate, Sheffield.—We regret that the address of this firm was erroneously given in our columns last week as "Leeds."

The British Electric Transformer Co., Ltd., "Tricity" Showrooms, 50, Oxford Street, W.1.—Catalogue No. 36 (36 pp.), with current price list. The former is an illustrated list of "Tricity" products, including electric fires, ovens, kettles, &c., profusely illustrated by means of photographs.

Messrs. Landis & Gyr, Ltd., Windmill Road, Hampton Hill, Middlesex.—Leaflet dealing with friction-compensated ampere-hour meters for D.C. two-wire circuits. Illustrated and dimensioned.

Credenda Conduits Co., Ltd., Chester Street, Aston, Birmingham.—Illustrated leaflet giving price and details of the new "Creda" kettle.

Messrs. Sterns, Ltd., of Royal London House, Finsbury Square, London, E.C., have issued a wall sheet with calendar for 1920, and a chart showing what lubricants they recommend for use for specified types of cars in summer and winter respectively.

Works Extensions.—The extensions are proceeding at the works of the General Electric Co., Ltd., at Witton. Land at the side of the London and North-Western Railway, between Aston and Gravelly Hill (with the canal running through the site), is rapidly being developed, and within the last three months the steel frame-work of several large factories has been erected. The shell of one large building on the ferro-concrete principle is rapidly approaching completion. A portion of the estate on the opposite side of the canal is being laid out for recreative purposes for the employés.

Canadian National Exhibition. — The forty-second annual Canadian National Exhibition will be held at Toronto from August 28th to September 11th next. Approximately 1,000,000 visitors attended last year's Exhibition. French manufacturers have applied for considerable space for the display of French products. United Kingdom firms should apply without delay to Mr. Waters, Canadian National Exhibition, King Street East, Toronto. Information regarding past exhibitions may be obtained at the Department of Overseas Trade, 35, Old Queen Street, S.W. 1.

Plant for Sale.—Rotherham Corporation invites offers for seven Lancashire boilers, two Green's economisers, also complete lay-out of steam and feed piping and valves. See our advertisement pages to-day.

Calendar. — Messrs. Metropolitan-Vickers Electrical Co., Ltd., of Trafford Park, Manchester, have prepared a wall calendar (April, 1920—March, 1921). The study emphasises the chilliness of the April morn on which we write.

Points from the Budget.—The postage rates on inland letters are to be 2d. for 3 oz. and ½d. for every additional oz. Dominion letters will be 2d. for 1 oz. and 1d. for every additional oz. Newspaper postage rates (inland) are to be advanced to 1d. for not exceeding 6 oz. and ½d. for each additional 6 oz. Parcel-post rates are increased, as are also rates affecting postcards, printed matter, &c. Inland telegrams will be 12 words for 1s. (instead of 9d.) and 1d. for each additional word. Telephone charges are to be dealt with after a Select Committee has reported on the matter. Taxes on motor cars and vehicles are revised as from January next, a H.P.-basis being adopted in place of the petrol tax. The duty on share capital is increased from 5s. per £100 to £1 per £100. The Excess Profits Duty, which in many quarters it was expected would give place to another form of tax, is to be raised from 40 per cent. to 60 per cent., and a new tax, to be known as "Corporation Tax," at the rate of 1s. in the £, or 5 per cent., on undivided profits of limited liability companies engaged in trade, is also added. In the event of a Bill being introduced later in the year making a levy on war-wealth increase, the 20 per cent. increase in Excess Profits Tax will be taken into account. Surprise is being expressed that the Corporation Tax has been imposed in addition to, instead of in place of, the Excess Profits Duty, as had been expected would be the case. There is to be relief from double income-tax within the Empire.

Book Notices.—"Report of the Fuel Research Board for the years 1918, 1919. (Department of Scientific and Industrial Research)." 57 pp. London : H.M. Stationary Office.—The report of the board, which consists of Sir George Beilby, F.R.S. (Director), the Hon. Sir C. A. Parsons, K.C.B., F.R.S., Sir Richard Redmayne, K.C.B., and Sir Richard Threlfall, K.B.E., F.R.S., covers an extremely wide field, the main points dealt with being "Oil Fuel for the Navy and the Mercantile Marine," "Survey of the National Coal Resources from the Physical and Chemical Points of View," "Peat Inquiries," "Alcohol as Fuel," and "Pulverised Coal."

"Tungsten Ores." By R. H. Rastall, M.A., F.G.S, and W. H. Wilcockson, M.A., F.G.S. 81 pp. London : John Murray. Price 3s. 6d. net.—This monograph, prepared under the direction of the Imperial Institute, presents, in Chapter I, a brief survey of the character, occurrence and uses of tungsten ores. Chapters II and III are devoted to sources of supply. The enormous demand for tungsten created by the war is graphically shown in a curve on page 2. The world's production from being about 7,400 metric tons in 1914, jumped to over 22,000 metric tons in 1917, the production of the British Empire rising from 3,900 tons in 1914 to 7,200 in 1917. Throughout the work, references to literature on the subject are given in parentheses, and an index is provided at the end.

L'Electro Journal, a commercial review of electricity which was established in 1915, but ceased publication about a year ago, has resumed regular appearance ; it is edited by M. G. Arbaud, at 1, Villa Ornano, 1—Paris (18e). Price 1 fr.

"The Chloride Chronicle." Pp. 32, No. 10. April, 1920.—The current issue of the Chloride Electrical Storage Co.'s magazine is full of bright interesting notes and articles, including "Recollections of Indian Life and Customs," and a descriptive contribution, "The Devil as Architect," illustrated by some very good photographs.

"The Coolidge Tube." By H. Pilon. Pp. viii + 96 ; 54 figs. London : Baillière, Tindall & Cox. Price 7s. 6d. net.

The Federation of British Industries has issued a useful pamphlet of 28 pages giving a financial review of 1919, by Messrs. J. S. M. Ward and N. E. Crump. It includes tables and charts showing the fluctuations in the rates of foreign exchange, and the prices of raw materials of industry.

"Electric Wiring : Theory and Practice." (Second edition.) By W. S. Ibbetson. Pp. vi + 463 ; figs. 218. London : E. & F. N. Spon, Ltd. Price 18s. net.

"Science Abstracts" (A. and B.). Vol. XXIII, Part 2. No. 266. February 28th, 1920. Price 2s. 3d. each net. Index (A. and B.) to Vol. XXII. Price 2s. 3d. each. London : E. & F. N. Spon, Ltd.

"America's Merchant Marine : Its History and Development to Date." New York : Bankers Trust Co.

Electrolytic Iron.—It is announced from Stockholm that the Conrad Werner Lindman, of the Avesta Ironworks, Sweden, has succeeded in developing a method for the electrolytic refining of iron. The experiments have been proceeding for six months, and specially good sheets are said to have been produced which are almost chemically pure, even, and homogeneous. The iron is made in thin sheets, having a higher magnetising capacity than ordinary rolled sheets, and can be turned out in the thinnest dimensions, and without requiring further treatment. The details of the process are kept secret.

Lundberg's Switching Competitions.—We understand that these well-known electric lighting switching examinations, which were conducted with such success by Messrs. Lundberg during the years previous to the war, have again been resumed, and that the papers for the next examination will appear in the columns of our contemporary *Electricity*, commencing with the issue of April 23rd.

American G.E. in Brazil.—The New York correspondent of a Birmingham newspaper says that on 17th inst. American General Electric securities were in demand on the Stock Exchange, on reports that the company had received a large order from Brazil.

The Southampton Strike.—The trade union members of the electricity works staff came out on strike, as stated last week, on account of the refusal of the power house superintendent, Mr. E. J. Hooper, to remain a member of the E.T.U. instead of transferring his allegiance to the E.P.E.A. Alderman S. G. Kimber, the Mayor of Southampton, was interviewed by a deputation upon the subject, and was asked if he could not persuade Mr. Hooper to at least remain an honorary member of the E.T.U. He replied that this was not a matter in which he could properly take action, and said that the decision lay with Mr. Hooper himself. Upon interviewing the latter, the members of the deputation were informed that the question had been referred to the headquarters of the E.P.E.A., and the association would endeavour to arrive at an agreement with the E.T.U. by which settlement Mr. Hooper would consider himself bound. In the meantime, while these negotiations were being proceeded with, the borough Electricity Committee had taken action. After carrying on with volunteer aid during the first part of the strike, by means of which the greater part of the service was maintained, the committee engaged new men to the extent of 80 per cent. of the vacancies created by the dispute. These men went to the works upon the express understanding that their positions would be permanent. The conditions under which the breach was filled by outside labour precluded the reinstatement of all but a small part of the strikers, and the trade unions were informed accordingly. This gave rise to threats of a general strike. On April 17th a mass meeting of members of several local branches of trade unions resolved that unless a satisfactory settlement of the problem had been reached by noon on April 20th the whole of the workers in Southampton would be ordered to cease work. The Corporation appointed a deputation to meet the men's representatives in the hope of averting this action, but the Mayor stated that if a general strike was ordered, the town would have to do its best to "carve its way through." As we go to press we learn that the strike has been settled. (See our leading columns.)

The Electrical Power Engineers' Association informs us that this dispute hinges on the fact that Mr. Hooper, a member of the staff of the electricity undertaking, recently resigned his membership of the Electrical Trades Union, and joined the Electrical Power Engineers' Association. Mr. Hooper was formerly a charge engineer in the generating station, but in November, 1919, he was promoted to the position of station superintendent. In this capacity he was in charge of the maintenance of the plant, and controlled a number of men who were members of various Unions, such as the A.S.E., &c. On his assuming this position he decided that he could not properly remain a member of the E.T.U., and consequently tendered his resignation, at the same time indicating his reasons for the step he was taking. Although Mr. Hooper was accepted as a member of the E.P.E.A. in February, the first intimation that the Association received of their grievance was that the E.T.U. members had come out on strike, and the Association contends that it would have been more reasonable on their part to discuss the matter with the E.P.E.A. before adopting such drastic measures.

The E.P.E.A. doubts whether the present strike is an official one, and has received the sanction of the E.T.U. executive, and it is for this reason that it is determined to support Mr. Hooper. It holds that this is a direct attack by one Union against another, and the E.P.E.A. is bound to defend itself and its members. Seeing that Mr. Hooper is a member of a recognised Trade Union, nothing but strong exception can be taken to any form of coercion which would compel him to abdicate his right to act as a free agent in the choice of a Union best fitted to serve his interests.

Mr. H. S. Ellis, Borough electrical engineer, asks us to thank the applicants for positions as shift engineers, junior charge engineers and general assistants, and to inform them that testimonials, &c., will be returned in due course. No further applications need be sent in, as the whole of the old staff has been reinstated.

Our Trade with India.—Commissioner's Visit to England.—In accordance with the practice that has been established for His Majesty's Overseas Officers when in this country to visit various industrial areas in order that manufacturers and merchants may have an opportunity of consulting them on any matters connected with their business or of obtaining information as to the possibilities of extending their overseas trade, it has been arranged for Mr. T. M. Ainscough, O.B.E., H.M. Senior Trade Commissioner in India, to undertake a tour of certain areas. Mr. Ainscough will commence his tour in London on Monday, May 3rd. Visits to other centres in the United Kingdom will follow in due course. He will be pleased to meet manufacturers and merchants who wish to consult him in regard to steps to be taken for opening up trade with India, and who are desirous of obtaining advice and information as to the state of trade in that country. Among the matters in regard to which he will be prepared to give information and advice are the general state of trade in India, appointment of agents, methods of marketing and distribution of goods, terms of payment, statistics of imports, rates of Customs duties and general information as to the openings existing for British goods. The Trade Commissioner is primarily interested in the imports from the United Kingdom into the Territory in which he is stationed, and not in the exports from that Dominion to this country. Firms desirous of meeting Mr. Ainscough should communicate without delay, with the Department of Overseas Trade, 35, Old Queen Street, London, S.W. 1.

Electric Meters in France.—The French Ministerial decree of July 29th, 1915, relating to the approval of various types of electric meters has been withdrawn.

Canada.—Motor Agency Wanted.—A Canadian firm have asked H.M. Trade Commissioner in Toronto to place them in touch with United Kingdom manufacturers of single-phase motors with a view to their representing such a manufacturer in the Dominion market. Firms interested may obtain the name and address of the firm on application to the D.O.T. Department in London.

Conveying Machinery for Norway.—Official reports received by the D.O.T. show that in Norway there is a general demand for conveying machinery of all kinds (*a*) for mines; (*b*) for factories, &c.; and (*c*) for docks and quays; owing to shortage of labour and high wages. Plans are under consideration for some large warehouses at the docks in Christiania, and these, it is believed, will be started in the near future.

Sequestration.—Messrs. Marshalls, electrical, mining and mechanical engineers, Townhead Works, Strathaven.—Estate sequestrated by the Sheriff of Lanarkshire, April 16th. Meeting to elect Trustee and Commissioners, April 27th, at the County Buildings, Hamilton. A composition may be offered. Claims must be lodged by August 27th.

Bankruptcy Proceedings. — H. H. Shave (H. H. Roberts), electrician, 228, Sultan Road, Portsmouth.—Receiving order made April 16th on debtor's own petition.

Liquidations and Dissolutions.—Spanish and General Wireless Trust, Ltd.—Winding up voluntarily for reconstruction purposes. Liquidator, Mr. S. Pears, 14, George Street, Mansion House, E.C. Meeting of creditors Arpil 29th.

E.I.C. Magnetos, Ltd.—Winding up voluntarily for reconstruction purposes. Liquidator, Mr. E. H. Sherrey, Cherry Street, Birmingham.

Trafford Power and Light Supply (1902), Ltd.—Claims must be sent by May 31st to the liquidator, Mr. C. Cooper, 60, Spring Gardens, Manchester.

Wright Brothers & Maidment, electrical engineers and contractors, 164, Sloane Street, S.W., and elsewhere. Messrs. H. T. and C. Wright and Mr. P. C. Maidment, have dissolved partnership. Mr. P. C. Maidment will attend to debts in respect of the business at Sloane Street, S.W., and Messrs. H. T. & C. Wright will attend to debts in respect of the business carried on under the style of Wright Bros. & Co., at 257, Fulham Road, S.W.

Swedish Price Advance.—It is announced that all the Swedish electrical engineering works have just made increases in the prices of generators, motors, &c., on account of the growth in the cost of raw materials, and the introduction of the eight-hour day. The demand for motors is said to be particularly great at present, partly because of the extension in the use of electricity in agriculture, and partly because of the development of Swedish industries.

Trade Announcements.—Messrs. Building Products, Ltd., have acquired the sole selling rights of "Pruflt" cement waterproofing paste and "Pruflitol" liquid waterproofer, as manufactured by Messrs. Rogers, Welch & Co., Ltd. The latter concern will continue to manufacture these specialities, but all sales will be effected through Messrs. Building Products, of 44-46, King's Road, Sloan Square, S.W. 3.

Mr. A. C. Wiley, the West of England representative of the Macintosh Cable Co., Ltd., has removed to Colston Yard, Colston Street, Bristol.

Mr. Harrold Stead having retired from the firm of Stead and Senior, electrical engineers, of 103, King Cross, and 48, Pellor Lane, Halifax, the business will be continued by Mr. R. F. Senior.

Messrs. Belco, Ltd., who have had a showroom in Kingsway since their foundation in 1913, are now exhibiting on their premises there (Windsor House) a variety of electric light fittings, electrical heating and cooking and other appliances. Semi-indirect bowl fittings are on view with Belcolux, Luxtral, and Holophane glassware. A large stock of their standard-type half-watt fittings is carried, and a pamphlet describing these has been issued. They also carry stocks of Burns's pattern telephone brackets—the "Hilo," which is adjustable for height or length, and an ordinary and cheaper pattern which is adjustable to differing lengths, and swivels radially on the front rod. A pamphlet relating to these has also been issued.

Mr. J. C. Elvy, consulting engineer, has now secured an office at 12, Tavistock Street, Covent Garden, W.C. 2, to which all communications should be addressed.

Mr. H. Hodgkins, of 81, West Road, Westcliff-on-Sea, informs us that he is the sole agent for the South, West and East of England and Wales below Northampton, excluding London, for the "Lotoc" electric bell.

German Lamp Prices.—The united electric glow lamp works in Germany have raised prices from 150 to 250 per cent. over the pre-war quotations.

A Danish Company.—The Avanti, Dansk Elektromekanisk Fabrik, of Kalundbore, reports that 1919 was a difficult period for the company, as well as for others in the metal industry, and the inconsiderable surplus earned has been carried forward. In the meantime the prospects for 1920 are specially favourable, and orders are in hand for everything that can be produced for the whole of the year.

LIGHTING AND POWER NOTES.

Africa.—Electricity Ordinance.—According to the *African World*, Mr. E. W. Cowan, consulting engineer, of Westminster, who is at present in British East Africa, has written a memorandum on the B.E.A. Electric Power Ordinance of 1918, in response to an invitation by the East African Section of the London Chamber of Commerce, in which he deals with the effect of the Ordinance upon progressive application of electric power in the Protectorate, and its effect upon existing installations. Mr. Cowan is of opinion that progress in the general use of electrical energy outside the townships and the residential areas is much more likely to take place along the lines of private supply rather than those of public supply. He does not contend that the procedure adopted under the Ordinance is in any way inappropriate in cases of application for a licence to provide a public supply of electrical energy, but submits, however, that the procedure is not appropriate in cases of private supply. And he points to the obvious difficulty, if not impossibility, of the procedure in the case of two or more estates desiring to adopt a joint use of power. "In many such cases," he adds, "communications must pass between proprietors and officials in England before the scheme can be completed. The fact that the machinery will generally be purchased in England involves necessarily a large part of the work being done there.

"The delay in endeavouring to conform with the procedure outlined in the Ordinance, when the greater part of the necessary information must be obtained from manufacturers and others in England, must be very serious, and in many cases so detrimental to the interests of the estates concerned as to result in abandoning the use of electric power and substituting some other of the many forms of power which, though less efficient and economical, will be free from Government intervention."

Australia.—Launceston.—Year's Working.—The city electrical engineer of Launceston, Tasmania, in his report for the year ended June 30th last, states that the total revenue amounted to £33,810 and the expenditure to £21,631, leaving a gross profit of £12,179, distributed as follows:—Interest on loans, £8,390; sinking fund, £1,780; general account, £1,800; and reserve fund, £209. The net profit fell from £4,086 in 1917-18 to £2,009 last year.

Ayr.—Bulk Supply.—The question of a bulk supply from Kilmarnock Corporation is being considered, and the Council has been advised to dispose of its present plant. The proposed charge for a bulk supply is £3 per kw. of annual maximum demand, plus 5d. per unit, the Ayr Corporation to provide the necessary sub-station.

Bedford.—Year's Working.—The recently-published report for the year ended March 31st, 1919, shows that the revenue accruing to the electricity undertaking was £49,983, and the expenditure £38,084, leaving a gross balance of £11,899. Payment of loan interest, &c., resulted in a deficit of £2,791.

Broadstairs.—Street Lighting.—The Urban District Council has accepted the offer of the Thanet Electric Light and Tramways Co. for public lighting where mains are already laid, at a yearly charge of £4 each for 100-watt, and £10 10s. for 300-watt lamps.

Clacton-on-Sea.—Extensions Approved.—The Urban District Council has been informed that it can proceed with the purchase of electrical plant, for which a loan of £9,500 is required, without waiting for the formal sanction of the Electricity Commissioners.

Clayton.—Street Lighting.—The District Council has received a letter from the District Coroner expressing the opinion of a jury that a recent fatal tramway accident was partly due to the absence of street lighting. The Council decided to attend to improvements.

Continental.—Sweden.—According to the *Engineer*, there are at present about 1,000 co-operative electrical societies distributing electricity in Sweden. The State erects the main cables and the transformers, the remainder is installed by the societies. The State has this year started an electrical power fund of one and a-half million kronor to facilitate the erection of power systems, and a power-station fund of two and a-half million kronor to facilitate the building of power stations. The State Pension Board Local Saving Banks and the Post Office Savings Bank also lend money to would-be introducers of electricity. Some of the distribution systems which were installed during the war have to be renovated, as such substitutes as zinc and iron wires were used, and found to be unsuitable.

France.—La Société de Transport de Energie des Alpes is the name of a new concern which has lately been organised in Lyons, with a capital of 2,000,000 fr., to establish plant in South-Eastern France to utilise water power for the generation of electricity.

The Compagnie Dijonaise d'Electricité has secured a concession of waterfalls and storage reservoirs on the River Lemme, on undertaking to supply light and motive power to the canton of Planches-en-Montagne, the city of Poligny and neighbourhood, setting up a distribution station there; and to the city of Dôle and district.

Belgium.—In order to meet the increasing demand for electricity, the Société des Centrales Electriques des Flandres is increasing the capacity of its generating station at Langerbrugge to 11,000 kw. The zone of supply of this station extends round the town of Ghent and along the banks of the Terneuzen maritime canal in an agricultural and industrial district which offers ample scope for further developments.

Darlington.—Rate Relief.—Instead of again carrying forward the whole of the profits on the electricity undertaking, £4,000 is being applied to the relief of the rates. In 1914 the electricity department contributed £4,205, and during the 1915-20 period £7,600.

At a recent meeting of the Corporation it was stated that the electricity charge was now only ½d. per unit above the pre-war price, and compared favourably with any other town in the country.

Doncaster.—New Plant.—The Corporation has received official sanction to proceed with the installation of two additional 3,000-kw. sets and water-tube boilers, &c., involving an expenditure of about £120,000.

Dublin.—Lighting During Strike.—During the recent general strike the street lighting was maintained upon the whole, but one or two parts of the city were in darkness.

Glasgow.—New Station.—The Corporation's new power station at Dalmarnock will be put into commission in about four weeks' time when one of the five generating sets will be in working order. Part of the load upon the St. Andrew's Cross station will then be transferred to the new plant.

Hereford.—Extensions.—The Electricity Committee has recommended application to the Electricity Commissioners for sanction to the installation of additional transmission lines, &c., at a total estimated cost of £81,407.

Leith.—Extensions at Docks.—Leith Dock Commissioners have approved a proposal by their superintendent for a tunnel under the Albert and Imperial docks, through which hydraulic, electric, gas, water and oil mains may be led. It is to cost about £10,000. The Commissioners have also authorised an expenditure of £10,000 on new electrical apparatus. Although they have large new schemes on hand, the Commissioners are not neglecting the improvement of their present undertaking.

Limerick.—Year's Working.—At a recent meeting of the Corporation, it was stated that a loss of £14,000 had been incurred in connection with the electricity undertaking.

Liverpool.—New Plant.—The Electric Power and Lighting Committee recommends the purchase of a new rotary converter for the Pumpfields station.

London.—Fulham.—The Finance Committee recommends application for a loan of £13,276 for the purpose of providing sub-stations, transformers, mains, &c., to cover the cost of "linking-up" with the Hammersmith undertaking.

Loughborough.—New Plant.—While not approving the whole of the scheme of extensions submitted to them by the Town Council, the Electricity Commissioners admit that extensions are necessary, and have sanctioned the installation of a 3,000-kw. generator. It is stated that the possibilities of a bulk supply from Leicester are very remote.

Nelson.—Loan Sanctioned.—The Electricity Commissioners have signified their approval of extensions to the electricity works, and have sanctioned the borrowing of £152,000.

New Zealand.—Coal Shortage.—The inadequacy of coal supplies has forced the Auckland City Council to consider the curtailment of the electricity supply or a temporary suspension of part of it. The requirement of the undertaking is 180 tons a day, and supplies have fallen so low that only about a day's reserve is held, the Council relying upon a daily delivery to keep the station running.

Stretford.—Loan.—The Urban District Council is applying for sanction to borrow £200,000 for the purpose of extending the electricity undertaking.

Stockton-on-Tees.—A Technical Advisory Committee has been formed, on the recommendation of the National Trade Advisory Committee for Electricity, Power, and Light.

Thames Valley.—Bulk Supply.—Arising out of correspondence between the Twickenham and Teddington Electric Supply Co., the Electricity Commissioners, and the Barnes District Council, the electrical engineer of the latter Council reports that it is felt that steps should be taken to provide a bulk supply station to deal with the demands in the whole of the Thames Valley area. Edmundson's Electricity Corporation feels that it would be wasteful to install further plant at the Twickenham generating station, and as it is certain, states the engineer, that in the near future a large number of the existing stations will be closed down, the necessity for providing a bulk supply station at the earliest possible date will arise. The Borough of Ealing feels the necessity for closing down probably more acutely than others in the neighbourhood, and it in consequence will welcome any proposal that will cheapen the cost of supply in its area. The Electricity Commissioners ask the engineers operating in this area if they think it worth while to prepare a preliminary scheme for submission to the Commissioners.

Tullamore.—Electric Lighting.—In connection with the recently formulated proposals, a site has been secured for a power station, and over £15,000 has been subscribed.

Walsall.—Industrial Requirements.—The Corporation has been refused permission to augment the generating plant until it is seen how the Electricity Supply Act will be applied in the district. Many industrial concerns are accordingly unable to obtain adequate power supplies, and the Chamber of Commerce has passed a resolution calling the attention of the Government to the harm that is being done through the delay.

Warrington.—Extensions.—The Corporation has made an application to the Electricity Commissioners to sanction a loan of £183,433 for the purpose of extending the existing plant at Howley. The electrical engineer has reported that the Commissioners have intimated that a new generating station at Warrington is not desirable at present, but the installation of a further generator will receive favourable consideration.

Whitehaven.—Revision of Charges.—With a view to simplifying the accounts, the Town Council has decided to charge domestic consumers a flat rate of 3½d. per unit for lighting to consumers who pay on the fixed charge system, instead of 2d. plus 52½ per cent.; and a flat rate of 1½d. to heating and cooking consumers, instead of 1d. plus 40 per cent.

Woolwich.—House Lighting.—The Borough Council has decided to have electric lighting installed in all the houses being erected on the new estate at Kidbrook, and to have the roads illuminated by electricity.

TRAMWAY AND RAILWAY NOTES.

Australia. — Launceston.—Year's Working. — The accounts of the Launceston, Tasmania, tramway system for the year ended June 30th, 1919, show a total revenue of £27,717, and against this an expenditure of £17,730, leaving a gross balance of £9,987. After payment of interest on loans, &c., the result was a deficit of £17, comparing favourably with the previous year's loss of £1,283.

Bolton.—Wages.—The Corporation's tramway employés have asked for double pay for the four days of the Royal Lancashire Agricultural Show in August. The Tramways Committee is considering the matter at its next meeting.

Continental. — France.— In spite of the enormous amount of work entailed the Société des Tramways de Lille has succeeded in putting 47 km. of the system in working order, and 63 cars are serving the various routes. In addition to this, power is being supplied to about 80 works in the district, and it is confidently anticipated that by the end of the present year the Société will be generating 10,000 kw., sufficient to meet all requirements.

Darlington.—Change of System.—After a four months' experiment with a 9-minute tramway service, it has been decided to revert to a 12-minute service. It was estimated that if the 9-minute service continued the loss would be £10,000 at the end of the financial year; the loss to the present time was put down at £5,500.

Egypt.—Tramway Strike.—For the fourth time in 12 months the Heliopolis tramway employés are on strike. The reason for their action is stated to be the suspension of a driver for insolence.

India.—Tubes for Calcutta.—The chairman of Calcutta Coporation, in outlining the scheme to the Communications Committee, wrote that there should be no serious obstacle to the construction of a tube under the Hugli, and in this way the suburb of Howrah could be linked up with Calcutta. The poorer classes were being crowded out of Calcutta by the increase of rents and land values, and would readily migrate to the suburbs if cheap and rapid transit were available. An estimate of cost given was £650,000 per mile. While the scheme is not yet formally adopted, the Committee approved the views expressed in the chairman's letter.—*The Times.*

Manchester. — Strike Settlement. — The tramway strike in Manchester and Salford has been settled. The terms are acceptance of the national award of 5s. a week advance, with an immediate review of base rates.—*Daily Telegraph.*

Middlesbrough.—Women Employes. — The Tramways Committee has instructed the manager, when engaging conductors, to employ a proportion of two-thirds men to one-third women.

Newcastle-on-Tyne.—Fare Revision. — In view of growing expenses, the Town Council has decided to revise the tramway fares on the basis of one mile for 1d., two for 1½d., and three for 2d., without overlapping-fare stages; the abolition of most of the ½d. terminal fare stages; revision of workmen's fares; and abolition of certain free-travelling facilities. An additional income of £60,000 to £70,000 is anticipated.

Runcorn. — Light Railway. — The Light Railway Commissioners have granted the application of Messrs. Castner-Kellner Co., Ltd., for an order to allow them to construct a branch light railway line giving direct access from their works at Weston Point, near Runcorn, to the L. & N.-W. Railway Co.'s system at Runcorn. A guarantee is required from the company that the line shall be so constructed as to be fit to carry passengers as well as goods, and it is probable that the line will be extended to connect with the neighbouring system.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—Wireless Rates.—The postal authorities, says the Sydney *Sunday Times*, advise that approval has been given for the adoption forthwith of a Pacific Marconi service, at a rate of 2d. per word less than the rate in force previously (2s. 10d., instead of 3s.) for full ordinary traffic only between Australasia and the United Kingdom, *viâ* Pacific and Marconi Trans-Atlantic Wireless Service. The Amalgamated Wireless (Australasia) Co. states that when the permission of the Federal Government to erect new high-power transmitting stations is received, charges will probably be reduced to 2s. per word.

Bradford. — City Exchange. — The city electrical engineer recommends that the existing telephone system within the Town Hall be scrapped and a new system installed, to cost about £3,300. When the Town Hall was extended 15 years ago, a central exchange was contemplated, but this was not built, and each department has had its own exchange wires, with a separate intercommunication system inside the Town Hall. The Finance Sub-Committee has decided to have a further report on the desirability of establishing an exchange within the Town Hall, in connection with the Post Office service, before coming to any conclusion on the matter.

China.—Wireless Stations.—Under the supervision of a British engineer, wireless telegraph stations are being established between Pekin and the farthest limits of Chinese territory in Turkestan.—*The Times.*

Germany.—Increased Postal Charges.—The new postal laws and regulations were adopted on April 17th by the German National Assembly. The charges for inland letters and telegrams are to be considerably increased, whilst telephone conversations are to cost double, and everyone who possesses a telephone will have to pay 1,000 marks for each line.

Telegraph Rates.—Proposed Increase.—Under the new Budget it is proposed to increase the telegraph rates from 9d. and ½d. for every additional word, to 1s., with ½d. per additional word over 12. An extra charge of 6d. will be made for every telegram handed in between midnight on Saturday and midnight on Sunday. The porterage on telegrams, now 3d. per mile from the limit of free delivery, is to be doubled. Telephone rates are to be increased at a later date.

Japan.—Wireless Telephony.—In 1919 the Japanese Department of Communications made a series of experimental wireless telephonic communications between land and sea, the land apparatus being at the Kobe Central Telephone Office. These experiments proved a success. The Department accordingly appears to have decided to provide two wireless stations at Kobe and Yokohama from the next fiscal year to open the wireless telephone business for the general public. Mr. Sayeki, the expert of the Department, is quoted by the Japanese papers as stating that the Kobe station will be opened from April next. Though no regulations have been framed, it is probable that the fee will be fixed at about 30 to 50 sen for a conversation.—*Economic Review.*

London.—Telephone Service.—During the last financial year there have been laid over 50 miles of single underground pipe line and 50,000 miles of underground wire, which brings the total length of London's underground telephone piping to 3,625, and the length of wire in it to over a million miles. The total pole mileage is 2,780, and the length of open wire on poles in London is over 60,000 miles. In laying underground pipes the needs of the areas are estimated for 15 years ahead. The present cost of this work is between £50 and £75 per yard.

New Zealand. — Telephone Shortage.—The Postmaster-General recently stated that the inability of his department to install the necessary telephones required by a great many people, was due to shortage of supplies arising out of war conditions. Difficulties had been increased by the changing over from the existing system to automatic working. The position was now improving, and it was hoped to accomplish a great deal in this direction during the year.

Poland. — The Polish Administration notifies the suspension of all private telegraphic correspondence with the outside world from April 17th to 26th inclusive.

South America.—Concessions to French Company.—Concessions have been made to the French South American Cable Co., says the *Board of Trade Journal*, for the establishment of telegraphic communication between Monte Video and Buenos Aires, and a submarine cable between Monte Video and Rio de Janeiro. The *Diario Official* of Monte Video of February 2nd contains a decree as under, giving the terms of the concessions:—The necessary authority is conceded to the French Cable Co. to establish and work submarine and terrestrial telegraphic communication between Monte Video and Buenos Aires, and a submarine cable between Monte Video and Rio de Janeiro. For each of the above concessions the company has deposited a sum of £3,260. The company will not enjoy any privilege, preference, or exemption, from national or municipal taxes. It will be subject to the different obligations, requirements, responsibilities, and penalties established by the Law of October 17th, 1919, and to the jurisdic-

tion of the Law Courts in accordance with the aforesaid Law. The company will also be subject to the other Laws of the Republic unless they affect the clauses of the concession. The company must present plans of the line followed by the cables in territorial waters and national territory, showing the landing sites, the testing office, and situation of buoys, signals, &c.

United States.—The annual report of the American Telephone and Telegraph Co. states that in co-operation with the Cuban-American Telephone & Telegraph Co., plans have been made to lay telephone cables to Havana, so that the principal places in Cuba will be in telephonic connection with the principal places in the United States.

Many mechanical labour-saving devices have already been adopted to meet the shortage of unskilled labour, and other devices are being constantly studied and adapted to the needs of the business. The department of development and research during the year has actively prosecuted work upon more than 500 improvements in the telephone art. The patent holdings of the Bell System have increased fully 12½ per cent. during the year, and it now owns or controls, or is licensed under, more than 5,000 United States letters patent and applications therefor.

At the end of the year the report shows that in the United States there were approximately 11,000 separate telephone companies. Of them, 36 are associated companies of the Bell System, 9,403 independent companies whose telephone stations are connected with the Bell System, and about 1,500 independent companies whose telephone stations are not connected with the Bell System. There is also a large number of rural lines and associations operated mainly on a mutual or co-operative basis, and not rated as companies. Of these lines and associations there are 26,184 which connect with the Bell System. At the end of the year the number of telephone stations which constitute the Bell System in the United States was 11,795,747, of which 7,739,159 were owned by the associated companies of the Bell System. The increase in the total number of stations in the Bell System during 1919 amounted to 729,748. There were 209,860 employés in the Associated Bell Companies at the end of the year, operating 24,162,999 miles of wire, of which 94·6 per cent. was copper. The net additions to the Bell-owned plant during the year were over $73,000,000. For the whole Bell System, with all duplications excluded, the total income, including compensation, after the deduction of expenses, amounted to $79,650,186, from which over $27,000,000 was paid in interest and $39,000,000 in dividends, leaving over $12,000,000 surplus. The surplus earnings in the last five months of the year since the end of Federal control have been $7,000,000. The capital stock, bonds, and notes payable of the Bell Telephone System outstanding in the hands of the public at the close of the year were $1,060,000,000, while the net assets devoted to earning return on these outstanding securities amounted to over $1,448,500,000. This is due to the fact that surplus and reserves of over $388,500,000 had been invested in productive property. For the American Telephone and Telegraph Co. the net earnings of the year were over $60,000,000. In round figures, the interest charges were $15,000,000; the dividends, $35,000,000; and the resulting balance, $9,000,000, of which $5,000,000 was appropriated to reserve for contingencies and $4,000,000 added to surplus. The company and its predecessors have paid dividends to the public at the rate of at least $7·51 per share each year for the past 38 years, and during the past 13 years the rate has been uniformly $8 per share. The number of shareholders in the American Telephone and Telegraph Co. was on December 31st, 1919, 120,460, an increase of 8,000 during the year. To this number should be added some 9,000 employés of the Bell System, who are paying for stock out of their wages.—*T. and T. Age.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the* Electrical Review *in which the "Official Notice" appeared.)

OPEN.

Auckland (N.Z.).—September 1st. Harbour Board. For the supply of electric capstans and spares. Messrs. W. & A. McArthur, Ltd., 18-19, Silk Street, Cripplegate, London, E.C. 2.

Australia.—Perth.—May 3rd. Postmaster-General's Department. Insulators, bolts, brackets, &c. Schedule 673. (April 2nd)

May 14th. Government of Western Australia. One 7,500-kw. turbo-alternator and condensing plant. (April 9th.)

Melbourne.—June 18th. City Council. Gas-filled metal-filament lamps. City Electrical Engineers' Office, Town Hall, Melbourne.

Belgium.—Antwerp.—May 21st. Municipal authorities. Tenders for 10,690 metres of armoured cables, required in connection with the electrical equipment of the Nos. 2 and 3 docks. Particulars may be obtained for one franc from the Hotel de Ville, Antwerp.

Cardiff.—April 29th. Corporation. One 5,000-kw. turbo-alternator and condensing plant. (April 9th.)

Carlisle.—April 27th. Electricity Department. One 1,000-kw. converter, switchgear for converter, E.H.T. feeder switchgear. (April 16th.)

Dartford.—April 26th. Urban District Council. One water-tube boiler and mechanical stoker; bus-bars. (April 16th.)

Dublin.—April 24th. Electricity Supply Committee. Seven truck-type switch cubicles for use on a three-phase 50-period 5,000 v. system. (April 16th.)

Edinburgh.—April 26th. Electricity Supply Department. E.H.T. paper-insulated lead-covered cables. (April 2nd.)

Lincoln.—May 24th. Electricity Department. Coal-handling plant. (See this issue.)

Leigh (Lancs.).—Electricity Department. One 2,500-kw. turbo-alternator; E.H.T. & L.T. switchgear; one 500-kw. rotary converter. (April 16th.)

London.—Shoreditch.—The Lighting Committee is inviting tenders for one turbo-generator, one water-tube boiler, and H. and L.T. switchgear.

Manchester.—April 27th. Tramways Committee. Electrolytic copper and bronze trolley wire; steel fishplates for tramway rails. Mr. J. McElroy, General Manager.

April 28th. Education Committee. Electric lighting installation at Birley Street, Beswick, and Princess Road, Moss Side, municipal schools. Education Offices, Deansgate.

Nuneaton.—May 5th. Electricity Department. 3 core and 4-core, L.T., paper-insulated cables. (See this issue.)

Portsmouth.—April 26th. Board of Guardians. Electrical installation at the Children's Home, Milton. (April 16th.)

Sheffield.—Corporation Water Works. Electric haulage winch, pug mill. (See this issue.)

South Africa.—Mossel Bay.—Electric lighting equipment. Contract No. 1.—High-speed superheated steam engines, boilers, air and circulating pumps, condensers, steam piping, valves, alternators, switchboard. Contract No. 2.—Poles, cross arms, lightning arresters, street lamps, brackets, repair tower, meters, conduit work, cables, &c. Particulars of general conditions, tender forms, &c., can be seen on application to the Department of Overseas Trade in London (Room 48, telephone extension No. 4). Copies can be lent in rotation to those firms in the Provinces having no representative in London.

Spain.—May 30th. Construction and working of an electric tramway between the Plaza de la Bonanova and the Monasterio de Pedralba, Barcelona. The Direccion General de Obras Publicas, Madrid.

Sunderland.—April 28th. Electricity Department. Water-tube boilers, superheaters, stokers, economisers and chimneys; one 1,000-kw rotary converter. Specifications, &c. (£1 each), from General Manager, Electricity Works, Dunning Street.

Tasmania.—Launceston.—June 7th. City Council. One 1,000-k.v.a. hydro turbo-alternator, with switchgear. City Electrical Engineer, Town Hall, Launceston.

Uruguay.—August 7th. Department of Posts, Telegraphs and Telephones. Construction of a national telephone system for the Department of Montevideo. Particulars from the Uruguayan Legation in London, 3, Elvaston Place, South Kensington, S.W.

Whitby.—Electricity Department. Replacing economiser, boiler feed pump, pipework; conversion of old dry duct into cooling pond. (April 16th.)

CLOSED.

Bootle.—Town Council. Accepted:—

Two 3½-ton electric vehicles, £2,545.—Ransome, Sims & Jefferies, Ltd.
Two 5-ton electric vehicles, £2,810.—Electromobile (Leeds), Ltd.

Edinburgh.—Messrs. Redpath, Brown & Co. were the lowest bidders for the steelwork at the boiler house of the Portobello power station, with an offer of £54,000, and the contract has been placed with them.

London.—Hackney.—Electricity Committee. The Committee recommends the cancelling of the contract with the Rees Roturbo Manufacturing Co., Ltd., for circulating pumps, at £1,708, the firm having given notice that the prices would be increased by 15 per cent. The electrical engineer, in view of the considerable increase in price, does not favour increasing the number of small pumps, but he may prefer to continue with the four existing pumps, and add, with the proposed extension, larger pumps, each with a capacity of 10,000 kw.

FULHAM.—Electricity and Lighting Committee. Recommended coal supply :—

6,000 tons Pooley Hall small nuts, £11,175 ; 2,000 tons ¾ pea slack, £3,425.—Foster & Co.
8,000 tons ¾ Midland slack, £14,633.—J. H. Gilman & Co.
3,000 tons Derbyshire nutty, £5,787.—Harrison's, Ltd.

SHOREDITCH.—Lighting Committee. Accepted :—

1 mile 8/·036 twin telephone cable, £96.—Edison Swan Elec. Co., Ltd.
2½ miles 7-core pilot cable, £750.—Union Cable Co., Ltd.

Margate.—Town Council. Installing the electric light at the Municipal offices, Town Hall :—

E. C. Spray (accepted)	**£148**
J. Owen & Sons	175
H. S. Tett & Co., Ltd.	188
W. J. Cannon	190
Glumart, Cox & Co.	196
Thanet Electric Co.	198
E. A. Pinto	228

Sunderland.—Town Council. Electricity Committee. Accepted :—

B. I. & Helsby Cables Co., Ltd.—House service cable and E.H.T. and L.T. cable.
Brush Electrical Engineering Co., Ltd.—Two 250-K.V.A. transformers.
Joseph Thompson & Co.—Creosoted redwood capping and cable troughing.
Ferguson, Pailin & Co., Ltd.—Switchgear.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, April 23rd. At the Institution, Storey's Gate, S.W. At 6 p.m. General meeting.

Physical Society of London.—Friday, April 23rd. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Fourth Guthrie lecture on "The Anomaly of the Nickel-iron Alloys," by Mr. C. E. Guillaume.

Royal Institution of Great Britain.—Saturday, April 24th. At Albemarle Street, W. At 3 p.m. Lecture on "The Thermionic Vacuum Tube as Detector, Amplifier and Generator of Electrical Oscillations," by Prof. W. H. Eccles. (Lecture II.)

Royal Society of Arts.—Monday, April 26th. At John Street, Adelphi. At 8 p.m. Cantor lecture "Aluminium and its Alloys," by Dr. W. Rosenhain, F.R.S.

Electrical Trades' Benevolent Institution.—Monday, April 26th. At the offices of the Electrical Contractors' Association, 11, Southampton Row, W.C. At 2.30 p.m. Annual general meeting.

"Dynamicables."—Tuesday, April 27th. At the Connaught Rooms, Gt. Queen Street, W.C. At 7.15 p.m. Anniversary dinner.

Institution of Civil Engineers.—Tuesday, April 27th. At Great George Street, S.W. At 5.30 p.m. Annual general meeting.

Institution of Electrical Engineers.—Thursday, April 29th. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Paper on "Automatic Protective Devices for Alternating-current Systems," by Mr. A. E. McColl.

(East-Midland Sub-Centre).—Tuesday, April 27th. At the Technical College, Loughborough. At 7 p.m. Lecture on "The Electrical Equipment of Ships," by Mr. C. H. Wordingham, C.B.E.

(Scottish Centre).—Friday, April 30th. At Dundee.

(Students' Meeting).—Friday, April 30th. At Faraday House, Southampton Row, W.C. At 7 p.m. Paper on "Tidal Power," by Mr. J. E. Holmstrom.

Association of Engineering and Shipbuilding Draughtsmen.—Thursday, April 29th. At Chesterfield Grammar School. At 7.30 p.m. Paper on "Gas Producer Plants," by Mr. J. J. Nicholson.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, April 30th. At the Literary and Philosophical Society, Newcastle-on-Tyne. At 6.15 p.m. Paper on "A Modern Power Station and its Development," by Mr. J. S. Watson.

Junior Institution of Engineers.—Friday, April 30th. At 39, Victoria Street, S.W. At 7.30 p.m. Social evening.

NOTES.

E.D.A.'s Age.—Referring to our leaderette of last week, Mr. J. W. Beauchamp points out that the Electrical Development Association started on June 2nd, 1919, and therefore is not only less than two years old, as we said, but has not even attained to its first anniversary. All the more credit to its efforts ; it is a lusty infant, but needs ample nourishment—many pounds a day—and it is up to the electrical industry to feed it.

Cardiff Turbo-Alternator Tenders : Correction.—By a printers' error in our advertisement pages last week we credited Cardiff Corporation with inviting tenders for a 50,000-KW. turbo-alternator. The plant required is, of course, of 5,000 KW. capacity.

Electricity v. Gas.—At a meeting at Bradford, on Saturday last, members of the Yorkshire Junior Gas Association attempted to console themselves with regard to the general demand for electric lighting in the new housing schemes, by referring at length to the supposed advantages of gas as a heating and cooking agent. In a paper by Mr. E. L. Oughton, of Huddersfield gas undertaking, tables were given which purported to show that in heating and cooking gas was "a long way ahead of electricity," but in the discussion some members disputed the strict logic of the figures. Mr. Roper, of Bradford, said that in his district the gas people were up against a very serious proposition in the electricity charges for domestic consumption, which were merely ¾d. per unit, with a basis charge of 15 per cent. on the rateable value of the house. He greatly doubted whether gas could meet that on the question of cost, and pointed out that the charge included everything, lighting or otherwise.

The Electrical Trades Benevolent Institution.—The annual general meeting of this Institution will be held at the offices of the Electrical Contractors' Association, 11, Southampton Row, W.C. 1, on Monday, April 26th, 1920, at 2.30 p.m. ; Mr. J. Y. Fletcher will take the chair, and it is hoped that members will show their interest by turning up in force. The meeting will receive the report of the Committee and the accounts for the year 1919, and elect members of the Committee of Management. The following members retire by rotation, and are eligible for re-election :—Messrs. W. B. Esson, E. Garcke, T. E. Gatehouse, C. E. Hunter, W. Ratcliffe-Small, Sir Ernest Spencer, and Mr. G Sutton.

Norwegian Water Power.—The *Technical Review* quotes from *Teknisk Ukeblad* a statement that the Government is providing a sum of one and a-half millions sterling for the regulation of rivers, in order to increase the value of waterfalls. The work is to be completed in 1922.

Electrical Power Engineers' Association.—The first annual dinner of the Northern Division was held in the Albion Hotel, Manchester, on April 17th, under the presidency of Mr. H. E. Annett, A.M.I.E.E., chairman of the division.

After the toast of "The King," Mr. A. L. Lunn, past-president of the Association, proposed the toast of "The Guests," and said he was pleased to see so many chief engineers present, as representatives of undertakings, as well as Ald. Walker, chairman of the Joint Board. He contrasted the large gathering with the first meeting of the Association which was held in Manchester, and said the progress was due, in some measure, to the sympathetic attitude of the great majority of chief engineers.

Ald. Walker, in replying to the toast, said he had ground for hostility to the E.P.E.A., seeing that he was spending every Saturday and Sunday, not in well-earned rest, but on the Joint Board endeavouring to find solutions to problems of rates, hours, and conditions. The electricity supply industry was THE key industry, and by the work of the Joint Board, the result of which would be attained at no distant date, he hoped they would create feelings of satisfaction amongst the staff. It could not be denied that many of those in authority in the electricity supply industry did not appreciate the technical knowledge necessary for those responsible for the generation and distribution of electrical energy.

Mr. J. F. Heslop, A.M.I.E.E. (vice-president of the Association) proposed the toast of the "Institution of Electrical Engineers," and Mr. J. A. Robertson (chairman, N.W. Centre of the I.E.E.), in replying, said he had watched with pleasure the progress and good work of the E.P.E.A. in improving the status of the engineer. There were so many conflicting interests represented in the I.E.E. that for it to undertake the function of a protective organisation would be its own destruction. Instead, the I.E.E. endeavoured to bring the various sections together. The local Centre had set up a committee to formulate a scheme for the training of station engineers. Technical education and training should be available for and accessible to the children of the poorest people. There was too much specialisation ; he would have engineers change from generation to distribution and to sales, rather than wait for promotion in their own department.

Mr. P. P. Wheelwright, M.I.E.E., proposed the toast of "The E.P.E.A.," suggesting a formula : Enterprise+Perseverance+Energy=Awards, which expressed his own view of the characteristics of the members who had made it such a success. Mr. J. H. Parker (president, E.P.E.A.), in replying, referred to the early difficulties of the Association. It was a baby which required nutrition, but the doctor told it to suck his thumb. This did not help, and it was decided to try a new food, "Bonus food builds bonny babies." This met with success, and an addition was prescribed. The baby was now making rapid progress, and a new food, "Basic rates," would be ready shortly. The Association was a most democratic organisation ; its members occupied an intermediate position, being both workers and managerial, and he looked forward to the time when it would hold the balance against trouble in the industry. In conclusion, he said that if the members worked together, nothing could restrain them from what they set out to do.

Standardisation in Germany.—In Germany the Association of German Engineers has, according to the *E.T.Z.*, set up a powerful organisation in the "Standardisation Committee of the German Industry" [*Normenausschuss der Deutschen Industrie*]. Standardisation falls into two main sub-divisions, namely, Regulation (*Regelung*) and Normalisation (*Normung*). The former is concerned with the drawing-up of regulations for the estimation of the capacity and behaviour of apparatus. The Committee holds that it is of the highest importance in view of the English and American activities in this sphere that the German regulations should be elaborated as quickly as possible, so as to strengthen the German position in respect of export. The latter relates to the specification of sizes in manufacture with the object of facilitating repetition work in respect of component parts, definition of types, and the determination of overriding standards such as normal sections, normal voltages, &c. The Committee referred to above comprises a number of sections composed of specialists in various branches, and it is proposed to add to these sections as the needs arise.

Railway Signalling.—The report of Major Hall to the Ministry of Transport on the collision which occurred between a passenger train and a goods train at Soothill Wood Colliery, on the Leeds-Batley branch of the Great Northern Railway, early in February, states that the severe storm at the end of January had resulted in extensive damage to block telegraph and telephone wires over a large area in this district, and traffic was still, on this branch, being operated under the block telegraph regulations. Major Hall agrees with the opinion, expressed in a recent report by Colonel Pringle, that the temporary installation of telephone block working by means of insulated cable run out from reels would be of the greatest value pending restoration of normal conditions.—*The Times.*

The Educational Activities of Glasgow Electricity Department.—The Works Continuation School of the Electricity Department of Glasgow Town Council has introduced during the past winter various classes for employés. A very successful session has just been completed, when Mr. R. B. Mitchell, general manager, presented prizes gained by past students. The classes met four nights in each week, and included the following subjects:—Practical training in instrument making, arithmetic and algebra, and generation and distribution of electrical energy. The latter class was for the clerical staff, and all were conducted under the auspices of the Local Education Authority.

On April 12th the session of the Glasgow Town Council Electricity Department Engineering Society was concluded, Mr. R. B. Mitchell presiding over an attendance of 88 members. Mr. C. W. Marshall read a paper on "Transformation of Electrical Energy from A.C. to D.C.," and an interesting discussion followed. The chairman intimated that arrangements were well in hand for the next sessions' syllabus.

Mine Locomotives.—It is stated that the Home Office has been approached with a view to permitting the use of electric locomotives in coal mines. At present, in accordance with General Regulation No. 136, haulage by electric locomotives on the overhead trolley wire system is prohibited in any mine in which coal is worked, but haulage by storage-battery locomotives may be used in any mine, with the consent in writing first obtained of the Secretary of State, and subject to such conditions affecting safety as may be prescribed by him. The use of internal-combustion locomotives is prohibited by the Act. The Department has laid down certain conditions, of which the most important is that the locomotive shall not, under any circumstances, spark in such a manner as to set up the danger of firing a mine. Designs have now been submitted to the Home Office for approval.—*Colliery Guardian.*

Electric Vehicle Progress.—The Bristol Town Council proposes to purchase six electric tipping wagons for the collection and removal of refuse. The estimated cost is placed at £6,600, and the sanitary authority hopes that as a result of displacing horse vehicles by electrics a saving of £1,000 a year will be effected. At the inquiry held by the Ministry of Health respecting the application to borrow the money to meet the cost of the vehicles, the city engineer explained that since 1914 the expense of keeping a horse had risen from 12s. 10d. to 42s. per week, mainly due to the high price of fodder. The men's hours also had been reduced from 61½ to 48 per week. In 1914 the cost per load of 25 cwt. of refuse was 4s. 4d., and it was now 14s. At one of the destructors there was surplus electricity, and the Council thought it could charge these wagons every night with that surplus electricity. One firm of electric vehicle manufacturers stated that if the Council did not save a shilling a ton on the first month's working, it would take the wagons back. The sanitary authority hoped to save £1,000 a year by means of electric wagons.

The Derby local authority has placed an order with Newton Brothers, Ltd., for the supply of two electric vehicles.

The Ministry of Health has sanctioned the borrowing of £7,520 by the Edmonton Council for the purchase of electric vehicles and motor vans.

Sanction has been received by the Hackney Corporation in respect of the application to raise a loan of £5,418 for the purchase of four electric vehicles (two 2-tonners and two 3½-tonners) for refuse-collection purposes.

The Leeds Corporation has accepted a tender by Electromobile (Leeds), Ltd., for the supply of an electric tipping wagon at a cost of £1,610.

Plymouth Corporation has reported favourably on the adoption of electrics for the sanitary services. The Committee is to purchase three electric vehicles for refuse removal, a pioneer sweeper and loader, and two tipping wagons, which can also be used as water tanks for street-watering purposes. To cover the estimated cost of the vehicles and the adaptation of stable buildings as a garage, it was resolved to seek sanction for a loan of £12,840.

The Rotherham borough engineer has been authorised to obtain tenders for the supply of two electric vehicles for use by the Highways Department.

The Wakefield Electricity Department has had one electric vehicle in use for some considerable time, another is on order, and the purchase of a third is under consideration.

The Wolverhampton Corporation is to experiment with an electric vehicle for the local public services.—*Electric Vehicle.*

New Electric Clock at St. Pancras.—In these days of long deliveries it is refreshing to hear of somebody who can make a prompt shipment of goods. A case in point is the large clock under the Arcade of the Midland Railway Terminus at St. Pancras, London. Travellers have doubtless noticed for some months that this clock has been out of commission. On March 20th, Messrs. Gent & Co., Ltd., Leicester, received instructions to electrify this clock, and install one of their "Waiting-Train" movements behind the dial, and, although no preparatory work had been done, by the afternoon of March 26th the large face had been cleaned, the hand mechanism adjusted, a new "Waiting-Train" movement installed, and the whole of the electrification of the clock completed, and going by 4 o'clock on that day. This clock, which appears to be of ordinary size, 6 or 7 ft. in diameter, is in reality 18 ft. across, only a few feet smaller than Big Ben of Westminster. As a single-dial clock it is the largest electric clock in London. The "Waiting-Train" mechanism used for driving this dial is a small compact piece of apparatus, occupying a space about 18 in. square. The motive power for driving the hands is obtained from the pendulum, through the medium of a ratchet-wheel and the usual crown gear. The accuracy of the time-keeping is not, however, dependent upon this, but the pendulum is arranged to have a slight gaining rate, and moves the hands with a steady motion through a half-minute space on the dial in about 27 seconds. At this point a masking pawl comes automatically into operation, and stops the drive. Exactly on the half-minute the impulse from the master transmitter releases the masking pawl, and allows the drive to continue. The hands, therefore, do not proceed in half-minute impulses, as in the case of small clocks, but at a uniform rate, with small periods of "waiting." The pendulum is self-maintaining, and is capable of developing up to nearly 30 times its normal power, so that wind or snow pressure on the hands of the clock cannot affect its time-keeping qualities.

Educational.—Faraday House.—The following appointments to Entrance Scholarships at Faraday House Electrical Engineering College have been made:—To Frank Douglas Goodchild (County School, Beckenham), a Faraday Scholarship of 50 guineas per annum, tenable for two years in College and one year in engineering works; to George John Moody (Alleyn's School, Dulwich), a Maxwell Scholarship of 50 guineas per annum, tenable for one year in College and one year in engineering works.

Manchester University.—We have now received a copy of the "prospectus" of the issue of the Manchester University "bonds" referred to in our columns last week. This novel publication has all the appearances of the usual method of publicity adopted by company promoters. It announces that "no copy of this prospectus has been filed with the Registrar of Joint Stock Companies," and the title assumed is "Lancashire Development Unlimited—The University of Manchester." The "capital" is divided into "425,000 cumulative participating ordinary bonds of £1 each," and 1,500,000 cumulative participating people's bonds of 1s. each. The "terms of subscription" are:—On application—"As much as possible" and on allotment payment may be spread over three years, at option of subscriber. A form of application is enclosed. Apart from the undoubted worth of the University to the country, this new departure, in attracting the attention and support which is essential to its continuation, deserves sympathetic consideration and response.

Vehicle Lights.—The Departmental Committee on Lights on Vehicles, of which Sir Henry Maybury is chairman, has made two interim reports to the Ministry of Transport, which have been published as a White Paper [Cmd. 659, 2d. net]. The subjects dealt with are lighting-up times, the number of lamps to be carried on various types of vehicles, and the restriction of the use of dazzle headlights. It is agreed that some of the headlights now in use are unnecessarily powerful, and that inconvenience and frequently danger arise from their use. The Committee has examined a large number of devices to reduce or eliminate dazzle. "While it is quite easy to avoid dazzle, the effect of most of the devices which do this satisfactorily is to produce an unsafe driving light," besides wasting a large percentage of light. The Committee recommends that the light given by all headlights should comply with some standard of illumination ascertained at various points. With a view to fixing such a standard, it proposes to subject all ideas and devices submitted to it to a series of practical road tests. Pending this investigation, the Committee suggests the limitation of the size of clear glass apertures of head-lamps to 7 in. diameter on motor cars, and 5 in. on motor cycles. Not more than two head-lamps should be allowed; not more than four lamps showing a light to the front to be permitted on any vehicle (except in the case of a vehicle with a load that overhangs laterally); not more than one separate rear light to be used except in the case of projecting loads; all lamps showing a light to the front shall have clearly and indelibly marked thereon their capacity or power, and shall not exceed 24 C.P.; if more than two lamps showing a light to the front are used, two of them must be side lights not exceeding 12 C.P. each. Legislation and special provisions are recommended.

The Electrical Purification of Air.—A note presented to the Académie des Sciences by Messrs. D'Arsonval, Bordas, and Touplain, and reproduced in the *Revue Générale de l'Electricité*, describes experiments on the purification of contaminated air by electrical means, the air being drawn through a copper tube in the axis of which was a wire maintained at a negative potential of 50,000 volts with regard to the tube. Although the air was proved to contain originally 150 microbes per $m.^3$, after electrification it was absolutely sterile. As experiments with dust particles had shown that the best results obtainable did not exceed a deposition of 95 to 97 per cent. of the particles, the authors concluded that the destruction of the microbes was partly due to the action of ozone, and their researches will be directed to this aspect of the matter.

Inquiries.—Makers of "Etcholite" and of the "Pulvo" vacuum cleaner are asked for.

Identification Marks on Motor Vehicles.—The Metropolitan Police have issued an emphatic warning with regard to faulty identification marks on motor vehicles. Warnings were given in 1917 and 1918, and some 6,000 offences were reported in the Metropolitan Police District in the latter year. A further warning is now given, for the last time, that the Police will insist on these marks being in compliance with the law.

Strike at Port Sunlight.—Electrical Trades Union men employed by Lever Bros. at the Port Sunlight works, who came out on strike on Wednesday of last week, owing to the employment of three men who are members of the Electrical Power Engineers' Association, have not, up to the time of writing, returned to work. Negotiations between the firm and the Union have been held, and a settlement may not be very distant.

Engineering Golfing Society.—The spring meeting will take place, by the courtesy of the Golf Club, at Coombe Hill, Kingston Hill, on Tuesday, May 11th. A medal round will be played in the morning, and a four-ball foursome competition against bogey in the afternoon. Entries close on Monday, May 3rd. A match play tournament will commence early in May; entries close on Monday, April 26th. The hon. secretary, Mr. W. L. Mansergh, 5, Victoria Street, Westminster, S.W.1, will be glad to furnish application forms and other particulars, to any members of the engineering profession who belong to recognised golf clubs, and wish to join the society.

Appointments Vacant.—Shift engineer (90s.) for the Hoylake and West Kirby Urban District Electricity Department; telegraph inspectors (£200 + £65) for the Posts and Telegraphs Department in the Tanganyika Territory; assistant lecturer in electrical engineering (£350) for the Manchester Municipal College of Technology; staff engineer (£234) for the Doncaster Corporation Electricity Department; full-time teacher of engineering (£350 to £450) for the Birkenhead Technical School; installation assistant (£250) for the Ipswich Corporation Electricity and Tramways Departments. See our advertisement pages to-day.

The Diesel-Electric Propulsion of Ships.—In the Shipbuilding and Marine Engineering Section of the *Times Engineering Supplement* for April, it is stated that the Diesel-electric system has many advocates in America, where a number of ships of 10,000 tons deadweight are being equipped with Diesel-driven D.C. generators, of 5,000 B.H.P. each, supplying current to the propeller motors. The engines are of the simple non-reversing type, running continuously at constant speed, and owing to the intervention of the electrical gear, can be run at higher speeds than when directly coupled to the propeller shaft, thus economising space and weight. The system lends itself well to the development of very large powers without the risks attendant on the use of large cylinders.

Spark Plugs.—Brass has often been assumed to be superior to steel for sparking-plug shells because of its greater heat conductivity. The measurements described in Report No. 52, U.S. National Advisory Committee for Aeronautics, prove the contrary, showing that the interior of a sparking plug, having a brass shell, is from 50° to 150° C. (90° to 270° F.) hotter than that of a similar steel plug. Consistent results were obtained in both an aviation and a truck engine, and under conditions which eliminated all other sources of difference between the plugs. It is to be concluded that steel is to be preferred to brass for sparking-plug shells.—*Technical Review.*

INSTITUTION NOTES.

Institution of Electrical Engineers.—The annual general meeting of the North-Western Centre was held on April 13th, at the Engineers' Club, Manchester, Mr. J. Robertson presiding.

The annual report, read by the honorary secretary, Mr. A. Ellis, stated that 11 general meetings had been held, including the Kelvin Lecture, and the attendance averaged 120. A noteworthy feature was the number of new speakers, including several visitors; on the average, eight speakers took part in the discussion at each meeting. There was an increase in every class of membership, the greatest being in the Student Section, where the figures were 222, against 128 last session, and the aggregate was 984, compared with 830. The Liverpool Sub-Centre had held five meetings and the Preston Sub-Centre six.

The Chairman, in replying to a vote of thanks, said they had every reason to feel proud of the work which had been done by the Centre, and also by the Institution as a whole. There was a tendency to bring together various interests, including the manufacturing interest, which, he was sorry to say, was ignored for many years by the Institution, to reconcile conflicting views, and to enable those who were apparently in opposition to one another to work together for the common good of the Institution and the industry as a whole. Personally, he had tried to emphasise the importance of the Students' Section and the necessity of encouraging it in order to maintain the strength of the Institution.

Thanks were voted to Mr. Ellis for his services as honorary secretary, and to the Committee of the Engineers' Club for allowing the meetings to be held on the club premises.

There were nine candidates for membership of the Committee, and a vote was taken by ballot, the successful candidates being Mr. H. A. Ratcliff, Mr. B. Welbourn, and Mr. J. H. Wood. The election of Mr. J. Frith (chairman), Alderman W. Walker and Mr. A. S. Barnard (vice-chairmen), and Mr. A. Ellis (honorary secretary) was agreed to unanimously.

The meeting was followed by a smoking concert.

South Midland Centre.—The hon. secretary of the Centre informs us that the authorities of the Technical College, Loughborough, and the Brush Electrical Co., Ltd., have extended an invitation to the members to visit their respective establishments. May 14th has been suggested as a suitable date for the visit, and a programme has been arranged. Members of the Centre desirous of taking part are asked to communicate with the hon. secretary (Mr. J. D. Morgan) not later than April 24th. The probable cost of the visit will be 10s. per member, as a motor-'bus is being hired for the occasion.

Scottish Centre.—Lecturing on "Highland Water-Power" to this Centre of the Institution in Glasgow, on April 14th, Mr. J. M. M. Munro dealt with the nature, need, and urgency of a preliminary investigation of the entire field of national portable and power water supply, and the organisation necessary to undertake it. The problem, he pointed out, was to utilise fully and distribute equitably the whole water resources of the country for the maximum benefit of all. The preliminary inclusive general survey could most quickly be accomplished under the auspices of interim district water committees, appointed by groups of county councils. Schemes ripe for accomplishment could be undertaken by permanent area water boards. A Government contribution towards cost would probably be necessary, but the main capital would be borrowed through local authorities and others interested in water or power supply. These boards would not distribute beyond their area, but would sell water there to local authorities and electrical energy to the district electricity authorities. At the same meeting office-bearers for the year were appointed as follows:—Chairman, Mr. J. E. Sayers; vice-chairmen, Mr. C. F. Goslin, and Mr. Alex. Lindsay; hon. secretary, Mr. Joseph Taylor; assistant hon. secretary, Mr. W. F. Mitchell; chairman, Students' Section, Mr. F. H. Whysall. Mr. Roger T. Smith, President of the Institution, delivered an interesting address.

Institution of Civil Engineers.—On Tuesday last the "James Forrest" lecture was delivered by Sir Dugald Clerk, F.R.S., the subject being "Coal Conservation in the United Kingdom." After a preliminary survey of the coal resources of the country, the author took as his text the report of the Coal Conservation Committee of the Board of Trade, and severely criticised the statistics put forward, and the economies ascribed to the scheme of electricity supply. He then compared the relative efficiencies of gas and electricity in terms of the heat units contained in the coal, and maintained that where heat was required, gas was far superior to electricity, while in a few years' time its superiority would be vastly increased. He saw little prospect of improvement in electrical plant, though, by abandoning condensation and using the exhaust steam from turbines for heating purposes, he considered that a very high thermal efficiency was obtainable. A suggestion of Lord Kelvin's that large quantities of low-temperature heat could be obtained with a small expenditure of energy by utilising the reversible properties of the Carnot cycle between narrow limits, Sir Dugald declared, was not a fallacy; it offered a promising opening for new developments. For lighting purposes he stated that electricity was more economical than gas. The advantages of gas for generating power, in preference to steam, were emphasied, and the lecturer concluded with a brief reference to the use of water-power.

The Council, in response to requests from various parts of the country, has decided to form local associations. These will, at first, only be instituted in centres where Associations of Students are already in existence, and the grant made by the Institution to these Students' Associations will be continued if the latter are incorporated with the newly-formed bodies. Various other rules regarding this matter have been formulated by the Council.

Liverpool Wireless Association.—A meeting was held on April 14th, at which additional new members were elected. A paper was given by a member with regard to valve action and circuits, followed by an instructional article on the construction of a standard wave-meter. The following gentlemen were elected as members of Committee:—Messrs. Grindon, Henderson, Coulton, Moore, Hyde, Saunders, and Williams. Mr. G. Irvine was elected hon. treasurer, and Mr. S. Frith, 6, Cambridge Road, Crosby, Liverpool, was re-elected as hon. secretary. The next meeting is on Wednesday, April 28th; all interested in wireless are cordially invited.

Birmingham and District Electric Club.—At the final meeting of the session, on April 17th, a paper was read by Mr. F. D. Davidson on "The History and Development of Electric Heating and Cooking." The author gave a short history of the experiments and difficulties of the pioneers in America, Germany and England, referring particularly to Franklin, Lane-Fox and Carpenter in America, and to Crompton and others in England. He expressed the opinion that for the purpose of water boiling and the like, the mica wire strip element, bolted in close contact with its work, was the most efficient heating element yet devised, and for heating purposes the porcelain former type of fire-bar was the most effective. A plea was made for some attempt at the standardisation of heating elements, and the suggestion was put forward that the most useful size of element for general purposes was an element 5 in. long by 1¼ in. wide, and not more than $\frac{1}{8}$ in. thick; this could be used singly or in suitable numbers for practically all forms of apparatus, the loading and voltages being varied to suit requirements.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Mr. GEORGE J. HOLLYER, chief assistant electrical engineer at the Walthamstow Electricity Works, has resumed duties after his recent illness.

Mr. ARNOLD HUGHES, Falkirk Corporation electrical engineer, has been granted three months' leave of absence for health reasons.

Mr. THOMAS CLIMIE has been appointed assistant electrical engineer by the Falkirk Town Council at £330 per annum.

The Hull Electricity Committee has unanimously agreed that the salary of Mr. H. BELL, the electrical engineer, be increased from £700 to £1,000 a year, dating from April 1st, 1919. In a letter to the committee Mr. Bell pointed out that his present salary was identical with that he received seven years ago. He also submitted an official scale of payments by units, and said that under this scale he would be entitled to £1,410 per annum. During his absence at the war the whole question had been in abeyance.

Mr. R. C. HILL, late of the Admiralty Salvage Department, has recovered sufficiently from a long and serious illness to enable him to undertake duties once more on the staff of the Gloucester Corporation Power Station, where he formerly held the position of Engineer-in-Charge.

Lieut.-Colonel A. SIMPSON has been appointed director; Capt. P. J. Edmunds, physician; Mr. H. N. Swinstead, traffic manager, and Capt. R. W. Hawl, instructor, wireless branch, Indian telegraphs.—*Indian Engineering.*

Mr. H. A. NEVILLE, chief electrical engineer of the Wakefield Corporation for the past 16 years, has been appointed electrical engineer and manager of the Peterborough Corporation electricity works at a salary of £750, rising by annual increments of £50 to £1,000.

Mr. R. COLLINS has resigned his position as engineer and manager of the Galway Electric Co., Ltd., on taking up an appointment with an engineering concern in Dublin. Mr. A. H. Pemberthy, manager of the Ruthin Electric Supply Co., has been appointed to succeed him. Mr. Pemberthy was formerly on the staff of the B.T.H. Co., Rugby.

Mr. W. E. MILLER has resigned his position as manager of the Carron Co.'s electrical cooking and heating department, and has taken over the electrical cooking and heating department of Messrs. Archibald Low & Sons, Ltd., of Partick, Glasgow, who intend to develop this particular branch very considerably in the near future.

Whitehaven T.C. has increased the salary of the borough electrical engineer to £450 a year. He had applied for £500, the recognised scale, but it was thought advisable not to pay this scale until the publication of the balance sheet at the end of the year.

At the Aylesbury electricity works, on April 9th, Mr. A. T. ATKINSON was presented with a silver cruet stand from the staff and employés, on the occasion of his marriage. Mr. Turnbull, the borough electrical engineer, made the presentation.

Commissioned Electrician W. Ross has been appointed to H.M.S. *Repulse* from the 3rd inst.

Mr. J. H. BOLAM, borough electrical engineer at Weymouth, has secured an appointment in India.

Mr. R. F. DIXON, works superintendent of the Southampton Corporation Tramways, who is leaving to become general manager and engineer to the Mansfield Light Railway Co., has been presented by the staff with a silver cake dish and a china fruit dish.

Mr. G. H. THURSTON, on retiring from the staff of the Isle of Wight Electricity Co., has been presented by his colleagues with a cake casket.

Mr. W. WETHERER, a lineman for nearly 50 years on the L. & N.W. Railway at Stafford, has been the recipient of a purse of money and an armchair from the members of the electrical department of the Stafford district.

Mr. S. G. MARSTON has resigned his position as mains engineer at Stoke-on-Trent, after 16 years' service with the Corporation, to take up an appointment as distribution engineer at Sunderland.

The *Times* states that Signor MARCONI has resigned his position as Italian delegate at the Peace Conference.

Mr. C. LE MAISTRE was married on April 16th at the Chapel Royal, Savoy, to Irene, younger daughter of Mr. and Mrs. Ernest van der Beeck, of Turpington, Bickley, Kent.

On Thursday last a farewell dinner was given by a number of his friends to Mr. E. C. BARTON, M.I.E.E., who is about to return to Australia after carrying on a strenuous campaign in support of decimal coinage and the metric system of weights and measures, and performing a variety of work of national importance during the war. Mr. Theodore McKenna presided, and amongst those present were Mr. Harry Allcock, Mr. G. L. Addenbrooke, Mr. Percy Rosling, Mr. Lee Murray, and Mr. W. L. Madgen, as well as many other men of eminence in scientific and commercial circles. Mr. Barton stated that hitherto Australia and New Zealand, whilst anxious to adopt the decimal system, had waited for the home country to lead the way; however, in view of the report of the Royal Commission on Decimal Coinage, he would endeavour to persuade them to wait no longer, but to carry out the reform independently of Great Britain.

Mr. J. R. D. NORRIE has resigned his position as electrical engineer to the Park Prewitt Asylum, Basingstoke. The appointment of a successor has been deferred for the present; the leading fitter and electrician will be responsible, under the direction of the medical superintendent, for the satisfactory working of the plant.

Mr. H. F. MARSHALL, charge engineer at the Barrow-in-Furness Corporation electricity works, has been presented with a dressing case by the works employés. He leaves England on April 24th to take up an appointment in Shanghai.

Obituary.—MR. H. W. ROBINSON.—The death occurred on April 14th of Mr. Herbert W. Robinson, local district superintendent for Messrs. Christy Bros. & Co., electrical engineers, of Chelmsford. He was 43 years of age, and had been with the firm for over 23 years.

MR. A. H. HIORNS.—There passed away on Saturday last Mr. Arthur H. Hiorns, who for about 40 years was head of the Metallurgical Department of the Birmingham Technical School.

PROF. J. A. MCCLELLAND, F.R.S.—We regret to record the death on April 13th, in Dublin, of Prof. J. A. McClelland, Professor of Experimental Physics in University College, Dublin. During the war Prof. McClelland was a member of the Inventions Committee and of the Committee for Organisation of Industrial Research.

PROF. A. K. HUNTINGTON.—The death occurred suddenly on Saturday last of Prof. Alfred Kirby Huntington, who was from 1879 until October, 1919, Professor of Metallurgy at King's College.

PROF. L. T. O'SHEA.—On Sunday last there passed away, suddenly, at Sheffield, Prof. L. T. O'Shea, for many years Professor of Applied Chemistry at Sheffield University. For more than 25 years he made a special study of the chemistry of fuel, especially in connection with coke-oven developments and the preparation of fuel for industrial purposes.

MR. T. VAIL.—We regret to record the death of Mr. Theodore Vail, which occurred on April 16th at the Johns Hopkins Hospital, Baltimore, from heart failure, at the age of 75 years. It seems that he had been in failing health for the past year. He was one of the best-known electrical men in the U.S.A., and he had also been prominently connected with important electrical concerns in South America, interests which brought him into personal contact with electrical men and others in London. An account of his career by "a correspondent" appeared in the *Times* of 19th inst. The writer says: "During the ten years of Mr. Vail's presidency of the American Telephone & Telegraph Co. the 'Bell' telephone system in the United States was increased from below 6,000,000 stations to nearly 12,000,000 stations, and the range of the telephone was increased until it covered the whole Continent, and New York was able to talk to San Francisco. Such a remarkable expansion of a complicated system of communication and such an extraordinary technical feat as the transmission of the human voice over a circuit more than 3,000 miles long required a highly scientific organisation. It is to Mr. Vail's recognition of the importance of scientific research that the great expansion and high efficiency of the American telephone system are due. . . . Many industries get their improvements from outside, but the telephone industry has almost consistently been improved from within by the inventions and advances of the research department of the American Telephone & Telegraph Co. . . . Mr. Vail had retired from the active presidency of the American Telephone & Telegraph Co., though remaining chairman of the board and retaining his active interest in the great work of telephone development.

Will.—The late Sir John Jackson, the well-known contractor, left £504,764 net personalty.

NEW COMPANIES REGISTERED.

Berrite, Ltd. (166,397).—Private company. Registered April 14th. Capital, £30,000 in £1 shares. To take over the business carried on by the Copal Varnish Co., Ltd., as dealers in insulating materials and compositions under the style of "Berrite," including the trade mark "Berrite." The subscribers (each with one share) are: E. H. Barchard, 22, College Hill, E.C., solicitor; P. M. Sanderson, 22, College Hill, E.C., solicitor's managing clerk. The subscribers are to appoint the first directors. Solicitors: Janson, Cobb, Pearson & Co., 22, College Hill, E.C.

Cooke & Segal, Ltd. (166,470).—Private company. Registered April 15th. Capital, £10,000 in £1 shares. To carry on the business of lighting, glass and hardware merchants, &c. The first directors are: W. E. Cooke, 22, Randolph Crescent, Maida Vale, W.; J. Segal, 94, Fairholt Road, Stoke Newington, N.16. Secretary: A. W. Wale, 93, Capel Road, Forest Gate, E. Registered office: 21-23, Gray's Inn Road, W.C.1.

E. B. C. Electrical Co., Ltd. (166,347).—Private company. Registered April 13th. Capital, £70,000 in £1 shares (20,000 preference). To carry on the business of manufacturers of and dealers in electric lighting and starting sets and accessories and equipment of all kinds for motor and other vehicles, vessels and aircraft, engineers, &c., and to enter into an agreement with S. L. Price. The first directors are: S. L. Price, 62, Eagle Street, High Holborn, W.C.; L. C. Harvey, 25, Victoria Street, Westminster; W. H. Carey, 78 and 80, High Holborn, W.C.; C. A. M. Buckley, 17, Drewstead Road, Streatham, S.W. Solicitor: F. S. Fleuret, 27, Chancery Lane, W.C. Registered office: 62, Eagle Street, High Holborn, W.C.

J. E. Slack, Ltd. (166,227).—Private company. Registered April 9th. Capital, £30,000 in £1 shares. To carry on the business of manufacturers of and dealers in tubes, pipes, conduits, mains, retorts, bends, elbows, flanges and accessories for tubes, pipes and conduits, &c. The first directors are: J. E. Slack, 343, Holloway Road, Holloway, N., director, Ferguson Superheaters, Ltd.; A. H. Spearing, Eversfield Road, Reigate, director, Ferguson Superheaters, Ltd., and Goodrich & Hamlyn, Ltd. Secretary: J. E. Slack. Registered office: 60, Queen Victoria Street, E.C.

Chesterfield Tube Co., Ltd. (166,341).—Registered April 13th. Capital, £435,000 in 70,000 shares of £1 each and 1,740,000 shares of 5s. each. To carry on the business of manufacturers of steel and iron tubes of wrought iron, steel or other metals, iron plates and fittings of all kinds, mechanical and electrical engineers, founders, machinists, &c., and to adopt an agreement with the Chesterfield Tube Co., Ltd. (incorporated in 1900). The first directors are: A. F. Nicol, Uplands, Woldingham, Surrey; C. C. Hatry, 36, Upper Brook Street, W.; P. Haig-Thomas, 43, Princes Gardens, S.W.; G. Hooper, Readings, Five Ashes, Sussex; A. Mitchelson, Holme Park, Rotherfield; H. W. Pelham-Clinton, 53, Eccleston Square, S.W.; W. A. Woodeson, Nevar House, Clowdene Bank, Low Fell, Gateshead (director, Clarke, Chapman & Co., Ltd.). Minimum cash subscription, £7. Secretary: J. G. Dinan. Registered office: 6, Austin Friars, E.C.

Don Engineering Co., Ltd. (166,456).—Private company. Registered April 14th. Capital, £200,000 in £1 shares. To take over the business of consulting, mechanical and electrical engineers, physical and scientific consultants, patentees, metallurgists, engineering experts, manufacturers of motor cars, cycles, scooters, buses, lorries, taxi-cabs, &c., and to adopt an agreement with Dr. A. M. Low. The subscribers (each with one share) are: Hon. C. N. Bruce, 1, Lowndes Square, S.W., barrister; Hon. N. M. Upton, The Holme, Balmaclellan, N.B., engineer. The subscribers are to appoint the first directors. Solicitor: T. Outer, 17, Throgmorton Avenue, E.C.

H. T. Hazzledine, Ltd. (166,208).—Private company. Registered April 9th. Capital, £10,000 in £1 shares. To carry on in the U.K. or elsewhere the business of electrical engineers and contractors, manufacturers of and dealers in electrical apparatus and appliances, &c. The first directors are: H. T. Hazzledine, The Cottage, Lucknow Drive, Nottingham; J. T. H. Barwood, 582, Berridge Road, Nottingham. Solicitor: S. J. Burnie, Moot Hall Chambers, Wheeler Gate, Nottingham. Registered office: 5, Talbot Street, Nottingham.

Bower & Taylor, Ltd. (166,193).—Private company. Registered April 9th. Capital, £5,000 in £1 shares. To take over the business of an automobile and electrical engineer carried on by J. A. Bower at 17-21, Thurlow Park Road, West Dulwich, S.E., as "Motor and Electrical Industries." The subscribers (each with one share) are: J. A. Bower, 42, Thurlow Park Road, West Dulwich, S.E., engineer; H. G. Stimson, Salisbury House, E.C.2, solicitor; W. J. Billing, 17, Oliver Road, Sutton, Surrey, clerk. The subscribers are to appoint the first directors. Registered office: 7-8, Great Winchester Street, E.C.

British Plugs, Ltd. (166,340).—Private company. Registered April 13th. Capital, £500 in £1 shares. To carry on the business of makers of sparking plugs, &c. The first directors are: D. F. Linstone, 45, Aberdare Gardens, N.W.6; S. Jacobs, The Briars, Park Hill, Moseley, Birmingham. Registered office: 86, Church Street, E.1.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

L. J. Healing & Co., Ltd. (97,137).—Return dated June 3rd, 1919 (filed January 20th, 1920). Capital, £100,000 in 5,000 preferred and 5,000 deferred shares of £10 each. 1,301 preferred and 5,000 deferred shares taken up. £13,010 paid. £50,000 considered as paid. Mortgages and charges, nil.

Bray, Markham & Reiss, Ltd.—Particulars of £8,000 debentures created March 24th, 1920, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908. The whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Venezuela Telephone and Electrical Appliances Co., Ltd.—Satisfaction in full on March 1st, 1920, of charge dated December 7th, 1908, securing £30,000 prior lien debentures.

Pinckney & Forster, Ltd.—Deposit on March 1st, 1920, of deeds of freehold premises at Newcastle-on-Tyne, to secure all moneys becoming due from company to Barclay's Bank.

British Union Lamp Works, Ltd.—Satisfaction to the extent of £2,239 on March 3rd, 1919, of mortgage or charge dated May 7th, 1913, securing all moneys not exceeding £3,000 for which the charges may become liable under a guarantee to company's bankers.

Fredk. R. Butt & Co., Ltd.—Particulars of £10,000 debentures created March 29th, 1920, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908. The whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Wilson-Wolf Engineering Co., Ltd.—Mortgage on certain land and buildings at Peterborough, dated March 22nd, 1920, to secure all moneys due or to become due from company to Lloyd's Bank, Ltd., Bradford.

United Flexible Metallic Tubing Co., Ltd.—Satisfaction in full on February 28th, 1920, of mortgage dated November 22nd, 1907, securing £2,020.

CITY NOTES.

Callender's Cable and Construction Co., Ltd.

Sir J. Fortescue Flannery, Bart, M.P., presided at a special meeting on April 15th at which it was resolved to subdivide the £5 shares into five shares of £1 each, making a much more marketable security, and to increase the capital from £900,000 to £1,300,000. In the course of his speech, the chairman said that trade had increased in such a way that they could not cope with the orders offered without providing special means for dealing with them. They had erected new works, enlarged some of the shops, and provided new machine tools. The turnover in money in proportion to the turnover in manufactured tons was very greatly increased. The average wage per man per week was 2½ times that of 1914. The weekly hours of working were then 53 and to-day they were 47, so that both as regarded the total amount of wages and the hours worked in return, there had been a change involving a very much larger outlay per ton of manufactured goods. There were several causes which made an increased capital necessary. In the first place there were the increased charges for buildings and fixed plant; secondly the increased cost per ton of manufactured cable; thirdly, the increased volume of orders; and fourthly, the increased facilities of a financial character which their customers expected, as compared with the Government, for whom they had been working during the last five years. They proposed to increase the working capital by £400,000 in the form of 400,000 £1 7½ per cent. cumulative preference shares, which would be called "B" shares, and would rank after the 6½ per cent. preference shares already in existence and in priority to the ordinary shares, both those which had already been issued and the balance which it was now intended to issue. They had fine business contracts both at home and abroad awaiting execution, and they looked forward to a satisfactory future. There were great developments of a scientific character—higher pressures, larger loads, longer distances for transmission and extension of the telephone system. Business in the Dominions across the seas and in foreign countries continued to expand, and they believed that the electrical industry had a very fine future.

Sir T. O. Callender said that in view of the great extension of electrical distribution throughout the country, he looked forward to a prosperous career for the company.

Swedish Companies.

The Elektriska A.B. K.B. Fréed reports net profits of 80,000 kr. for 1919, and a dividend at the rate of 10 kr. per share.

The Svenska Ackumulator A.B. Jungner has declared a dividend at the rate of 18 per cent. on the preference shares for 1919, and 10 per cent. on the ordinary shares.

The Elektriska A.B. Eck, of Partille, reports a loss of 905,000 kr. for 1919, as compared with net profits of about 1,000,000 kr. in the previous year, when a dividend at the rate of 12 per cent. was paid on the share capital of 6,000,000 kr. The loss is attributed by the directors to the necessity for making special provision for depreciation of manufactures and installation materials, and is to be covered partly by absorbing the balance brought forward from 1918, and partly by drawing upon the reserve fund.

The Allmänna Svenska Elektriska A.B., whose report and accounts for 1919 were summarised in our last issue, decided at the annual meeting on April 12th to pay, not 10 per cent. as recommended, but 12 per cent. In explanation, it was stated that the discount rate had been increased since the report was prepared, and this was causing difficulties to some of the shareholders who had mortgaged their shares. It was resolved to draw upon the profit equalisation fund for the amount of the difference of 2 per cent.

Brush Electrical Engineering Co., Ltd.

The report for 1919 shows a balance of £148,685, plus £34,714 brought forward. Depreciation of buildings and plant absorbs £9,400; depreciation of patents and goodwill £600; in addition to the 6 per cent. paid on the prior lien participating second debenture stock a further 4 per cent. is paid, £2,044; there is put to general reserve £70,000; 15 per cent. is to be paid on the ordinary stock, requiring £15,787, and £85,568 is to be carried forward. After the war the company quickly resumed its normal manufacturing operations. Important industrial contracts have been completed, and numerous others are in hand, in both the engineering and the car-building departments. £54,164 was expended on capital account during the year. In order to extend the works and to build houses for employés the capital is to be raised to £600,000 by 344,220 new ordinary shares of £1 each, part of which new capital is to be issued at an early date. It is considered that before any fresh capital is raised the present ordinary shareholders, in view of former reductions of capital, are entitled to benefit by the improvement in the company's position, and it is recommended that £105,244 of the reserve be capitalised and distributed to present holders in the proportion of £1 of new stock for each £1 now held. The demand for Brush-Ljungstrom power plant and auxiliaries has developed so satisfactorily as to necessitate a further enlargement of manufacturing capacity, and important extensions of buildings and plant for this purpose are in progress.

Calcutta Electric Supply Corporation, Ltd.—Final dividend for the last half of 1919, 6 per cent. actual, making 10 per cent. for the year, on the ordinary shares, with a bonus of one preference share for every ten ordinary shares held. A permanent increase of dividend on the preference shares from 5 per cent. to 6½ per cent. is recommended.

Hastings & District Electric Tramways Co., Ltd.—After paying 3 per cent. on the preference shares on account of 1919, £2,500 is put to depreciation and £526 carried forward.

Electrical Utilities Corporation.—Quarterly dividend of 1¾ per cent. on preferred stock.

English Electric Co., Ltd.—The report issued just as we go to press recommends a dividend of 8 per cent., less tax, on the ordinary shares for 1919, carrying forward £45,302.

British Electric Transformer Co., Ltd.—Mr. A. F. Berry presided at the meeting held on 14th inst., at Hayes, at which the resolution was passed increasing the preference dividend from 6 per cent. to 7 per cent., and increasing the capital to £1,000,000 by the issue of 137,500 preference shares. He referred to the enormous dimensions of the electrical industry, in which 150 millions had been invested. It was neither a hot-house plant nor a war creation. Manufacturing firms of all kinds depended largely upon a supply of power through the Berry transformers. They were also required largely for electrified railways and wireless telegraphy. The domestic demand for electricity was developing at an unprecedented rate. It was that which was making such a call on the company's manufacturing capacity for patented and perfected appliances on view at 50, Oxford Street. He hoped that the time was not far distant when they could pay more than 12½ per cent. on the ordinary shares. The company, during the war and since the armistice, had not earned so large a percentage of profit on its output as it had done in the best pre-war time. It was their intention to maintain their pre-eminence over other countries, and the increased scale of operation on which they worked would, he hoped, make it possible to out-distance still further their rivals.

Auckland Electric Tramways Co., Ltd.—Mr. C. G. Tegetmeier presided at a meeting of shareholders held at Auckland several months ago, at which he explained the terms upon which the undertaking had been acquired by the City Council. The amount payable was £1,227,200, which the company would receive in debentures for £834,400 at 5½ per cent., and for £392,800 at 5 per cent. The whole of them were payable on July 1st, 1940. Those debentures constituted the sole assets of the company, and the question to be considered was how they could be dealt with in the best interests of the shareholders. After discussion the meeting passed a resolution which the chairman promised to intimate to the London board, to the following effect: (1) That the company be wound up as speedily as expedient; (2) that, in distributing the assets of the company, the liquidator be requested, if practicable so to do, to propose a scheme whereby the debentures of the Auckland City Council be distributed among the shareholders of the company.

West India Electric Co., Ltd.—Capital expenditure during 1919 $7,554 in connection with the expansion of lighting and power business, necessitating additions to the wiring system in Kingston, St. Andrew, and Spanish Town. Gross earnings $383,665, an increase of $88,940. Total operating expenses increased by $92,360. Operating expenses 64.54 per cent. of the receipts, against 51.99 per cent. in 1918. New rolling stock being needed to keep pace with increased traffic, the car bodies were made at the company's works in Kingston, the trucks, wheels, and electrical equipment being imported. After deducting fixed charges, bond interest, &c., $83,567 and $16,500 interest on Canadian investments have been added to surplus. After debiting $40,000 distributed to the shareholders, the credit balance on surplus account now stands at $627,076.

Cuba Submarine Telegraph Co., Ltd.—Total receipts for 1919 £78,852; expenses £26,603. After providing £2,584 for cable repairs, £6,300 for income tax, £15,000 on account of excess profits duty for 1918, the balance is £28,364, plus £22,486 brought forward. £10,000 has been added to general reserve and £2,500 to pension fund. Dividends 10 per cent., less tax, on the preference shares, and 5 per cent., free of tax, plus a bonus of 4s. on the ordinary, leaving £21,150 to be carried forward subject to excess profits duty. The cable repairs referred to above have been in shallow water.

Stock Exchange Notices.—The Committee has specially allowed dealings in the following under temporary regulation 4 (3):—

British Aluminium Co., Ltd.—400,414 ordinary shares of £1 each, fully paid, Nos. 900,621 to 1,301,034.

General Electric Co., Ltd.—41,666 ordinary shares of £1 each, fully paid, Nos. 2,033,335 to 2,075,000.

Canadian General Electric Co.—Profit for 1919 $1,617,989 from which $524,668 is deducted for depreciation. Dividends 8 per cent. on the common stock and 7 per cent. on the preference; $313,300 carried to credit of profit and loss. The proceeds of the issue of $1,000,000 last December are to be applied to extensions of manufacturing and distributing properties.

City of London Electric Lighting Co., Ltd.—At a special meeting, held on 14th inst., it was resolved to increase the capital to £2,000,000 by the creation of £800,000 shares, and to subdivide the £10 preference and ordinary shares into shares of £1 each.

Alldays & Onions, Ltd.—It is proposed to increase the capital to £650,000 by the creation of 375,000 further ordinary shares. The whole will not be issued at the moment, but negotiations are in progress for issuing immediately 250,000 of the shares. The new capital is needed owing to the higher price of all commodities, and the great increase in business offering.

Johnson & Phillips, Ltd.—Dividend at the rate of 12½ per cent. per annum, less income tax, on the ordinary shares.

Buenos Aires Port & City Tramways, Ltd.—Meetings of the bondholders and debenture stockholders are to be held on April 26th for the purpose of considering proposals for the realisation of the property and assets forming the securities of those holders. A scheme has been prepared by Sir William Plender, the receiver and manager, having for its object, in the event of failure to realise the properties and assets for a sufficient cash sum, their acquisition by a new company to be formed for the purpose.

Merthyr Electric Traction & Lighting Co., Ltd.—Dividend 6 per cent. per annum on the ordinary shares; to reserve £1,200; to renewals £5,000; carried forward £581.

Fairbairn Lawson Combe Barbour, Ltd.—Dividend 7½ per cent. on the ordinary shares for 1919. To reserve £20,000; carried forward £32,982.

Bath Electric Tramways, Ltd.—After paying debenture interest, and preference dividend, £12,500 is put to contingencies and renewals account, and £4,251 is carried forward to provide for contingencies and replacements.

South Staffordshire Tramways Co.—Dividend of 4 per cent. on the preference shares for 1919, carrying forward £683.

STOCKS AND SHARES.

Tuesday Evening.

The Stock Exchange markets accorded the Budget something of a mixed reception. Certainly it is a relief to the investor to hear there will be no more national loans on the grand scale for the purpose of raising "new" money. On the other hand, the expectation of excess profits duty being abolished is sadly dashed by the tax going up to 60 per cent., while the new burdens thrown upon limited liability companies do not conduce to satisfaction on the part of shareholders. The immediate effect has been to cause a fairly general decline amongst industrial shares. At the same time, the question arose as to whether the 20 per cent. additional E.P.D. may be regarded as a useful excrescence when the inevitable modifications of the Budget come up for discussion.

With every prospect of a further big rise in the price of coal, it is natural that the harassed householder should turn to electricity and ask whether he cannot obtain some relief from his bills by greater use of the current. Though the latter depends upon coal, it is already being examined from the standpoint of domestic economy, and this will doubtless be an incentive to the electricity supply companies to demonstrate afresh the various advantages it offers over coal. In the meantime, however, prices of the London companies' shares are not exciting to the proprietor. Westminster ordinary changed hands the other day as low as 5½, which is but the fraction above the par value of the shares, and this in spite of the recent rise to 10 per cent. in the dividend. City of London ordinary are 10s. lower at 12½, the "arrears" of dividend in this case being a neglected factor. County ordinary have lost their small gain of last week. Several preference issues are slightly lower, though this is due more to monetary considerations than to anything else. The rise last week in the Bank Rate to 7 per cent. has predisposed all fixed-interest investments to dulness, and it requires little offering of stock to make a marked effect upon such securities. It is known that there are many newcomers that may be appealing before long for money, in spite of the Budget disabilities, and they will have to offer terms so tempting as will give the older stocks an expensive appearance by comparison. The public recognise this clearly enough, and this explains, of course, to a large extent the abstention of capitalists, large and small, from the Stock Exchange markets.

One department where firmness stands out is that for cable stocks and shares. The closing of the lists for application in respect of the new issues made by the Eastern group has already brought about recovery in the senior shares. Improvements have occurred in Eastern ordinary, "China" shares, Globes and Westerns, the first-named now standing highest in the quartette. Globe preference, however, are lower at 9, following the general trend of fixed-interest securities. Indo-Europeans are down £4 on account of the reduction of 3 per cent. in the dividend. Anglo-American Telegraph preferred receded to 79½, part of the loss being represented by the dividend deduction from the price. Marconis gave way to 3½, the market reason for the setback being the condition of the Italian rate of exchange. United River Plate Telephones are 2s. 6d. better, and Orientals continued their recovery with a similar rise.

The Brush Electrical report makes a fine showing. Profits have risen substantially, and the figures justify the recent improvement to 120 in the price of the ordinary stock. Dealings have taken place within the past few days in the 4½ per cent. debenture stocks, the firsts being 65 and the seconds 59½. Edisons are a good market, with a rise to 1 3-16, but other manufacturing shares are quiet and uninteresting. Metropolitan-Vickers preference at 2 7-16 and Henleys 2½ are

both ex dividend. Callender's have slipped back to 8¼. British Aluminium drooped to 23s. 1½d., and amongst engineering shares, Babcock & Wilcox went back to £3. Telegraph Constructions remain dull at 24¼. It is assumed in the market that the large sums just raised by the new issues of stock by the Eastern Companies will be spent, at least in part, upon work in which various manufacturing concerns will share, and if this turns out to be so, the latter should have plenty of contracts for some time to come.

British Electric Traction ordinary is lower at 33¼. The revised scale of tramway fares which came into operation last Sunday has not sent buyers exactly rushing into the market, where, indeed, dulness is still the order of the day. Undergrounds are weak. The 6 per cent. Incomes have shed 4 points to 68, and the £10 shares retreated to 2⅞, while Metropolitan ordinary stock at 20¼ is the fraction down. Districts shed a point.

Foreign traction stocks have again declined. Anglo-Argentine Tramways are easier, and Mexicans incline to the lower side. Mexican Light First Bonds have lost 5, at 39. Brazil Tractions have recovered a point, but except for this, the foreign group offers no consolation to stockholders. Bombay Electric ordinary are now ex their dividend of 49s., and the shares changed hands at 125 a couple of days before the dividend was taken off the price. Rubber shares move in sympathy with the dwindling tendency shown by the raw material, and in the armament group there is no fresh activity. It will take a week or two for the effects of the Budget to wear off, and business is hardly likely to revive to any noticeable extent until the Chancellor's provisions become more familiar and more digested. Meanwhile, it is the Excess Profits Duty which is worrying the markets more than anything else.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1918.	Dividend 1919.	Price April 20, 1920.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	8	12	6½	—	£9 4 8
Charing Cross Ordinary	4	7	8¼	—	9 0 8
do. do. do 4½ Pref.	4½	4½	2¼	—	8 8 8
Chelsea	3	4	3	—	6 8 4
City of London	8	10	12½	— ¼	8 0 0
do. do. 6 per cent. Pref.	6	6	8¼	— ¼	6 9 8
County of London	7	8	9⅛	— ⅛	8 13 10
do do. 6 per cent. Pref.	6	6	8⅝	— ⅛	6 17 2
Kensington Ordinary	6	7	5	—	7 0 0
London Electric	Nil	2½	1⅜	—	5 2 6
do. do. 6 per cent. Pref.	6	6	8½	—	9 4 8
Metropolitan	5	6	8¼	— ¼	8 5 6
do. 4½ per cent. Pref.	4½	4½	2⅛	—	8 0 0
St. James' and Pall Mall	10	12	8¼	—	8 16 10
South London	5	6	3⅝	—	7 12 8
South Metropolitan Pref.	7	7	18/9	— 1/-	7 0 0
Westminster Ordinary	8	10	5⅜	— ¼	9 6 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	79½xd	—3½	7 11 0
do. Def.	33/6	1¼	18⅛	—	8 0 0
Chile Telephone	6	6	6¼	—	*4 13 2
Cuba Sub. Ord.	7	7	10	—	*7 0 0
Eastern Extension	8	10	15½	+ ¼	*6 9 1
Eastern Tel. Ord.	8	10	160½	+3	*6 5 0
Globe Tel. and T. Ord.	8	10	15⅜	+ ⅛	*6 7 0
do. do. Pref.	6	6	9	— ⅛	6 13 4
Great Northern Tel.	22	—	22½	—	9 15 6
Indo-European	13	10	44½	—4	5 12 4
Marconi	25	—	8¼	— ⅛	6 15 6
Oriental Telephone Ord.	10	—	2⅜	+ ⅛	8 11 0
United R. Plate Tel.	8	—	7⅛	+ ⅛	*5 1 7
West India and Panama	1/8	—	1	— 1/16	6 5 0
Western Telegraph	8	10	15⅜	+ ⅛	*6 7 0
Home Rails.					
Central London Ord. Assented	4	4	47½	—	8 8 6
Metropolitan	1	1½	20½	— ¼	6 2 0
do. District	Nil	Nil	18	— 1	Nil
Underground Electric Ordinary	Nil	Nil	2⅜	— ⅛	Nil
do. do. "A"	Nil	Nil	7/-	—	Nil
do. do. Income	5	4	68	— 4	5 17 8
Foreign Trams.					
Anglo-Arg. Trams. First Pref.	Nil	Nil	3⅛	— ⅛	—
do. do. 2nd Pref.	—	—	5⅛	—	—
do. do. 5 Deb.	5	5	60⅜	—1½	8 5 4
Brazil Tractions	—	—	51	+ 1	—
Bombay Electric Pref.	6	6	17½	—	8 8 7
British Columbia Elec. Rly. Pfce.	5	5	56½	—3	8 17 0
do. do. Preferrred	3½	5	49½	—	10 10 6
do. do. Deferred	Nil	3	42½	—	7 1 2
do. do. Deb.	4½	4½	55⅛	—1	7 13 2
Mexico Trams 5 per cent. Bonds	Nil	Nil	36½	—	Nil
do. 6 per cent. Bonds	Nil	Nil	23½	—1½	Nil
Mexican Light Common	Nil	Nil	13½	—	Nil
do. Pref.	Nil	Nil	22½	—	Nil
do. 1st Bonds	Nil	Nil	39	—5	—
Manufacturing Companies.					
Babcock & Wilcox	15	—	3	— ¼	*5 0 0
British Aluminium Ord.	10	10	1 5/16xd	— ⅛	8 13 2
British Insulated Ord.	12½	15	1 7/16	— ⅛	7 14 8
Callenders	25	—	8¼	— ¼	7 11 6
,, 6½ Pref.	6½	6½	4⅞	—	6 16 10
Castner-Kellner	20	—	4	—	—
Crompton Ord.	10	—	22/-	—	9 1 10
Edison-Swan, "A"	10	—	1 1/16	+ 1/16	8 8 6
do. do. 5 per cent. Deb.	5	5	79½	—	6 6 9
Electric Construction	10	—	23/-	—	8 13 10
Gen. Elec. Pref.	6¼	6¼	18/6	—	7 0 6
do. Ord.	10	—	12	—	*5 14 4
Henley	25	15	2¼xd	—	7 1 2
do. 4½ Pref.	4½	4½	3⅜	—	6 4 2
India-Rubber	10	—	13¼xd	—	*7 8 2
Met.-Vickers Pref.	—	8	2 2/16xd	—	6 11 2
Siemens Ord.	10	10	27/6	—6d.	*7 5 6
Telegraph Con.	20	20	24½	—	*4 18 0

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Tuesday, April 20th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	2/10	1/5 inc.
a Ammoniac Sal	per ton	£100	...
a Ammonia, Muriate (large crystal)	,,	£92	...
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£42	...
a Copper Sulphate	,,	£52	...
a Potash, Chlorate	per lb.	1/-	1d. inc.
a ,, Perchlorate	,,	1/3	...
a Shellac	per cwt.	£23	£14 dec.
a Sulphate of Magnesia	per ton	£18	..
a Sulphur, Sublimed Flowers	,,	£38	...
a ,, Lump	,,	£35	...
a Soda, Chlorate	per lb.	6d.	...
a ,, Crystals	per ton	£12	...
a Sodium Bichromate, casks	per lb.	...	...
METALS, &c.			
g Babbitt's Metal Ingots	per ton	£118 to £345	...
c Brass (rolled metal 2" to 12" basis)	per lb.	1/0½	¼d. dec.
c ,, Tubes (solid drawn)	,,	1/6 to 1/6½	¼d. dec.
c ,, Wire, basis	,,	1/3½	¼d. dec.
c Copper Tubes (solid drawn)	,,	1/8½	½d. dec.
g ,, Bars (best selected)	per ton	£163	£3 dec.
g ,, Sheet	,,	£163	£3 dec.
g ,, Rod	,,	£163	£3 dec.
d ,, (Electrolytic) Bars	,,	£113	£4 dec.
d ,, ,, Sheets	,,	£156	...
d ,, ,, Wire Rods	,,	£128	£14 dec.
d ,, ,, H.C. Wire	per lb.	1/4½	¼d. dec.
f Ebonite Rod	,,	3/-	...
f ,, Sheet	,,	2/6	...
n German Silver Wire	,,	3/-	...
h Gutta-percha, fine	,,	15/-	...
h India-rubber, Para fine	,,	2/3½	...
i Iron Pig (Cleveland Warrants)	per ton	Nom.	...
l ,, Wire, galv. No. 8, P.O. qual.	,,	£57	...
g Lead, English Pig	,,	£40 10/-	£2 10/- dec.
g Mercury	per bot.	£35 10/-	40/- to 50/- dec.
e Mica (in original cases) small	per lb.	6d. to 4/6	...
e ,, ,, ,, medium	,,	5/- to 10/-	...
e ,, ,, ,, large	,,	12/6 to 25/- & up	...
g Phosphor Bronze, plain castings	,,	1/7 to 1/11	...
g ,, ,, rolled bars and rods	,,	2/3 to 2/6	...
g ,, ,, rolled strip & sheet	,,	2/3 to 2/9	...
d Silicium Bronze Wire	per lb.	1/11½	...
r Steel, Magnet, in bars	,,	1/8	...
g Tin, Block (English)	per ton	£343 to £344	£4 inc.
n ,, Wire, Nos. 1 to 16	per lb.	5/3	2d. dec.
White Anti-friction Metals	per ton	£90 to £345	...

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
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A.C. Haulage Signals.—In a paper by Mr. A. Lees, read before the Association of Mining Electrical Engineers, and reprinted in the *Iron and Coal Trades Review*, the use of D.C. for working signals in mines is stated to have been the cause of much lost time. The employment of accumulators means periodical charging in many cases at a station situated some distance from the signalling apparatus, and a man with a certain amount of skill and experience in the work is required to look after them. Motor-generators also require skilled attention, and a breakdown usually affects several haulages. The writer has conducted numerous experiments in an endeavour to arrive at a satisfactory method of employing A.C. of low frequency for this class of work. Rectifiers were found satisfactory in so far as D.C. bells require less power than A.C. The construction of rectifiers must be very substantial, and they should be able to rectify both waves of a whole period. The writer recommends the use of small transformers, as they give very little trouble, and are most reliable. Anti-sparking devices are dealt with, and tests described; a relay system is favoured, although it is pointed out that there is a limit to the number that can be employed in any one circuit. The transformers employed by Mr. Lees in his trials were 500 volts primary with tappings for 25, 20, 15, and 10 volts on the secondary. In concluding his paper, the writer sums up the principal advantages following upon the use of A.C. for signalling in mines, which are:—(1) No electrolysis at the bell wires; (2) The source of current is reliable; and (3) The cost of maintenance is low. Against these must be set higher first cost, but taking into consideration the time lost on D.C. systems, and the cost of maintenance, the bigger outlay is amply justified.

Electrical Engineering Service in the Navy.—The Navy Estimates for 1920-21 provide for various votes for electrical services, amongst these being the Department of Electrical Engineering, the staff of which is composed as follows:—Director of Electrical Engineering, £1,063 per annum; two assistant directors, £1,700; three electrical engineers of the higher grade, £2,025; 16 first assistant electrical engineers, £5,100; one examiner of accounts, £383; technical staff, 43 in number, £8,763; clerks, £537.

CAPITALISTS ALL!

By H. R. TAUNTON.

(*Concluded from page* 486.)

Their chance of decreased dividends on their actual capital value is certainly comparable with that of the ordinary shareholder. Apart from sickness (which affects the earnings of the workmen) they run the risk of reduced earnings by temporary unemployment. If the firm does badly, the same causes which reduce the dividends of the ordinary shareholders reduce those of the employés, for they are put on short time or are discharged in time of slackness; and their capital is depreciated by association with a firm that fails, and by long periods of unemployment. On that score alone they deserve the same consideration as the ordinary shareholders.

But they have a further merit which he has not. For it is entirely due to their right use, not only of their own capital but of his, that there are any surplus profits to discuss. They are the active agents in the prosperity of the firm; he, merely a sleeping partner.

If every employé be worth to the firm exactly what he is paid, no more and no less, then the firm will earn just sufficient to pay its preference holders, and its ordinary shareholders at the same rate. And the employés, considered as shareholders, will also have received their dividends, at the same rate. Every member of the firm, in such a case, will have received equal remuneration, in proportion to his merits.

It might be argued, indeed, that the employés would be doing their fair share if they earned the standard rate of interest on their own capital only; and that by earning additional interest on the really unproductive capital of the shareholders, they are doing more than their share. But unless they did that, the nominal shareholders would receive nothing at all. It is part of the employés' contract that they earn dividends on all the capital in the firm, the nominal shareholders' as well as their own; and the value of their holdings—or in other words, their pay—is assessed on their ability to do so. If they fail to do so, their own value is reduced, and with the failure of the company, they lose, at least temporarily, their dividends. And it must be remembered that, in return for this obligation on them to earn dividends for their sleeping partners, they have the privilege of receiving their dividends first, and at short intervals, in the shape of their weekly or monthly pay. Only after their claims are satisfied are those of even the preference holders considered.

So we come back to our former proposition that, when the body of employés produces just sufficient to pay all the shareholders, themselves included, the standard rate of interest, their annual value to the firm is precisely the total of their pay. There may be, of course, individual cases of over- or under-valuation, but they are foreign to the argument.

But if they produce *more* than the profit sufficient to afford equal remuneration proportionate to each member's capital holding, then it is obvious that they are doing more than their fair share. Their value to the firm is more than they have been assessed at. And the greater the surplus profit, the greater is this disparity.

The merit of realising that surplus profit belongs entirely to them, and in no wise to the shareholders. And yet it all goes to the shareholders, and they get nothing. They so use their capital—brains and muscle—as to increase the shareholders' capital—money—by more than the standard rate of increase, and so earn for them more than the market value of their money. This is more than they contracted to do. Then, they should receive more than their normal rate of pay, which is based on their ability to earn for the shareholders the standard rate of interest only.

And they don't receive it. Our firm gives an extra £12 to the ordinary shareholder, whose only merit is the taking of a slight risk; and gives nothing at all to the employés, shareholders too, who also take a risk, and have the additional merit of using the resources of the firm to such advantage that there is a surplus to divide. The facts have only to be considered in the light of a logical sequence of arguments for the injustice to be obvious. It clamours for correction. And its correction is a simple matter, if we proceed on the agreed hypothesis that every member of the firm, nominal shareholder and employé alike, is a capitalist, each with a holding in the firm, represented either by cash, or the capitalised value of services.

On this basis, the preference shareholders are paid the market rate for the use of their capital, say, 8 per cent.

The employés are paid the same rate for the use of *their* capital; and in consideration of the fact that they earn the surplus available for distribution, they receive their dividends first, and in frequent instalments.

After they and the preference holders are paid, the ordinary shareholders have admittedly a claim on the surplus to the extent of the market rate, 8 per cent., for the use of their money.

There is still, we are supposing, a surplus to be divided, equal to 12 per cent. on the ordinary shares. For the sake of argument, say the ordinary shares in this particular company are half the total nominal capital, or £125,000; so that our present surplus is £15,000.

We have now two classes of claimants to this surplus: the ordinary shareholders, whose claim is the risk they run of a deficit; and the employés, whose claim is that the surplus was earned by their efficient use of the firm's capital. Morally, the latter claim is the stronger, and they should receive the larger proportion. But it would be difficult to decide what that proportion should be; and, on this side of Utopia, it will be convenient—and policy—to treat the claims as equal.

The surplus, then, should be divided between the ordinary shareholders and the employés in proportion to their respective holdings, remembering that they are all capitalists. The total holding of the ordinary shareholders is £125,000; that of the employés is £1,000,000, based on the previously assumed pay roll of £80,000 per annum. The shareholders, therefore, should get one-ninth of the surplus (or £1,666), and the employés the remaining eight-ninths. In other words, the shareholders get an extra 1⅓ per cent. on their capital, and the employés get 1⅓ per cent. on theirs; the former in consideration of their "risk," and the latter on account of their efficiency. So that our old friend, Brown, whose capital holding we calculated to be £2,500, would get at the end of the year an extra dividend of £33 odd. No great sum, indeed, but an increase of one-sixth of his income.

In the same way, the office boy would get £4 6s. 8d. extra; the £500 a year manager £83 odd; and the managing director at £1,500 a year, something like £250, in addition, of course, to his dividends as an ordinary shareholder.

It will be seen that no employé, from high to low, gets a sum which could be called an exaggerated remuneration for his super-normal efficiency. But it is more than capitalist employers have hitherto been willing to offer; and it has the great merit that it is not a *limited* sum. The limit being removed, there is a real inducement to the employé to do his utmost to increase the next year's profits, and his resultant extra dividend.

If, for example, the surplus be sufficient normally to pay 40 per cent. on the ordinary shares (and such

dividends are not rare nowadays), each member of the firm would get an extra dividend of 35/9 per cent. on his capital holding. The ordinary shareholders would thus get 115/9 per cent. on their money; and the employés would find their annual earnings increased by about 45 per cent. The advantage to them increases rapidly as the profits increase beyond the point necessary to pay the standard rate of interest all round.

High rates of profits would be commoner under such a system of unlimited incentive than they are now. Under the half-hearted co-partnership or bonus schemes so far put forward, with small and uncertain rewards, strictly limited, the employé—more especially the workman—feels, even though he does not consciously express his feeling, that it pays him better to spin out his job, and get the extra money so earned, than to finish it quickly on the problematical chance of sharing in a microscopic bonus which, at the best, cannot exceed a certain low limit.

Remove this limit; let him realise that he is a shareholder with every right that the ordinary shareholder has of participation in the profits, and you give him the incentive hitherto lacking to increase his output, and so increase the profits of which he will receive his fair share.

And national reconstruction will become a tangible reality, instead of a vision obscured by the nightmare of class jealousy.

Of course, such a scheme as here outlined depends for its fair working on a just assessment of each man's capital value, which, in turn, means fair wages and salaries. There would be a natural tendency on the part of employers to underpay their staff; partly on the ground that their pay would be made up to normal by their extra annual dividend, but principally in order that their capital value might be underestimated to the benefit of the ordinary shareholders.

So far as the workmen are concerned, the danger is not a great one. They have their trade unions to protect their interests and fix their standard rates of pay. The clerical staff, however, have no such organisation, and they would be the most likely victims of unscrupulous employers, more particularly in the higher grades.

On the other hand, there are opportunities of injustice in the opposite sense, in the case of managing directors and others, who have been known to receive salaries and fees out of all proportion to the value of their services.

However, there would be an easy means of checking such irregularities, and one which is a natural development of the principle that every employé is also a shareholder. As such, he is entitled to a voice in the control of the company, and that in proportion to his holding. It would, therefore, be a predominant voice (in the majority of industrial concerns), and that being so, employés would naturally elect directors who would safeguard their interests. They would thus have a direct control over the amounts paid to themselves and their fellow members on the staff.

However, the correlated question of the participation of the employés in control is outside the scope of the present article, which is primarily concerned with their participation in the profits.

Such a scheme as that outlined above is unfortunately likely to prove neither grateful to employers and capitalists, nor acceptable to organised labour. Labour will look with the suspicion engendered of past experience on any scheme that seeks to increase the output of the workers on whatever specious pretext. They will look askance on the gifts of the Greeks, and will need much convincing that that increased output will primarily benefit the workers. They will sniff, too, at the idea of co-operating with directors and managers; and will be very indifferent to the claims of the clerical staff to advantages equal to those of the manual workers. And they will say the scheme does not go far enough; why allow an equal share—why any share—to the capitalist? But until we can reintroduce the golden age of barter, money is a tool as essential to labour as the lathe in an engineer's shop, and Labour must be prepared to pay the fair price for its use. It is simply a matter of justice, to which even a capitalist is entitled; and, on lower grounds, of policy.

The capitalist, on the other hand, will say the scheme goes too far. The men will earn too much money—awful thought!—and the shareholders too little. To upset the ancient fetish of the supremacy of money; to put the value of brains, and character, and skill, on an equal footing with it, will be to invite financial disaster. To admit as a right what they have hitherto grudged as a favour—full co-partnership; and to submit to the corollary, employés' co-operation in the management, will be to them as revolutionary as, a hundred years ago, the claim of the common people to a share in the government of the country must have seemed to the squirearchy of those days.

But this revolution, like that, will as certainly come in the natural development of free thought. Better to co-operate willingly in the inevitable, than to be forced to accept it in its harshest aspects.

Again, acceptance of the principle of such a scheme, though to the man of money it may appear to involve the reversal of all his privileges, and the loss of a large part of his easy earnings, will find its compensation in added security, increased output, and greater national wealth. True, the individual capitalist would never again have his disproportionate share of it; but better an equal share than no share at all, which may be his lot if he continues his opposition till triumphant Labour dictates it. And there is such a thing as altruism . . . though, to be sure, 'tis a quaint word to use to a shareholder!

And there is justice. No sophistries or special pleading can discount the justice of the employés' case, as here set forth; no opposition prevent it from ultimately prevailing. *Fiat justitia, ruat coelum.* Let justice be done, though all the little heaven of the men of money crash about their ears!

HINTS ON TENDERING.

By "INTERESTED."

How peculiar are some of the manners adopted by business firms when tendering! Looking through a batch of tenders received, the first impression from one cursory glance perhaps creates in the mind visions of a huge factory and workshops with hundreds of employés, and then one "comes to earth," as it were, by reading that delivery cannot be guaranteed until, say, a month later than the time stated in most of the other offers, and no explanatory note is enclosed giving any excuse or reason for the lengthy time required before being able to execute the work. In another instance, there is one which sticks hard and fast to the exact letter of the printed contract form, with but a curt note submitting the tender; nothing further is offered, although one part, or one schedule, is omitted and not quoted.

Again, an estimate will arrive offering all manner of goods except those required, and enclosures proceed at considerable length to explain details of the goods or jobs not desired.

At various times it has fallen to my lot to report upon batches of tenders received for many different lines of engineering goods reaching most branches of the trade, and a few suggestions may afford some guidance to persons interested.

First, if you cannot supply that for which the inquirer asks, say so without hesitation, and politely invite from him another inquiry at a later date should any business be likely to result. By that I do not mean that no alternative offer should be made for a different make of goods, other than that suggested in the specification or, in certain circumstances, with a slight difference in size, pattern or type.

Secondly, state clearly on both form of tender and covering

letter what extras are included, and do not leave to the prospective customer what often amounts to a vexatious trouble—searching out the sum of those items.

Again, the delivery date should be definitely stated, or else properly qualified reasons should be given, together with an estimate, for any probable delays.

When an inquiry includes certain labour for erection and setting to work, particular attention should be paid to any "fair wages" clauses and, before quoting, details of wages in force in that particular locality in which the work is to be undertaken should be ascertained.

In those circumstances where it is necessary to quote sums fluctuating according to the metal market, the tenderer should see that the basis figure is distinctly shown, and that the percentage, or sum to be added (or deducted) against the rise or fall in market prices of each metal, is given and not grouped. Such grouping sometimes works out to the detriment of the contractor, and not always against the customer.

When dealing with public authorities, it should be remembered that the time and date given as "not later than—" is strictly adhered to, as five minutes late generally ensures the quotation being marked "Received too late for consideration." That is the customary practice, notwithstanding a special explanatory note accompanying the tender, and an assurance given that the offer will be placed before the Committee. The tender is duly brought to Committee, but is not considered.

Alternative offers usually receive consideration provided they have not the effect of materially altering plans already decided upon.

Quite a good plan is to follow up the tender by a representative call, not, however, without first writing and inquiring if the proposed call is convenient, and giving as the reason a desire to explain more fully certain details incorporated in the offer submitted.

There are many real live business houses that have no need for suggestions such as these, but even at the present time many examples arise of those things being done which ought not to have been done, and estimates, quotations or tenders in such cases are just waste of good time and paper.

Finally, prompt attention and just consideration to the wants of a prospective customer usually bring in return fair and proper consideration.

THE STABILISATION OF SHIPS BY MEANS OF GYROSCOPES.

By P. R. JACKSON.

(*Abstract of paper read before the* Institution of Naval Architects.)

The present paper describes some recent developments which demonstrate the practicability of theories previously discussed by the members of this Institution.

The simplest wave system is a long ocean swell such as is encountered in deep water after a gale, and the profile of such a system of waves probably very closely approaches a sine curve. Actual wave formations as met with in rough weather, however, do not conform to this profile, because the period does not remain constant for any length of time. In a confused sea rapid changes in phase of the waves occur, due to several wave systems being imposed on one another.

In order to obtain definite data an instrument was constructed to draw a curve of the actual oscillations of a vessel when rolling freely under wave impulses. If we examine one of these diagrams (fig. 1) we see that the roll gradually increases by comparatively small successive increments, then dies down again, and almost immediately commences to build up again. These times of increasing roll represent the state of affairs when the period of the wave impulses approaches the natural period of oscillation of the ship, and is in phase with the ship's oscillations; when the impulses become markedly out of phase with the ship's roll the amplitude is reduced.

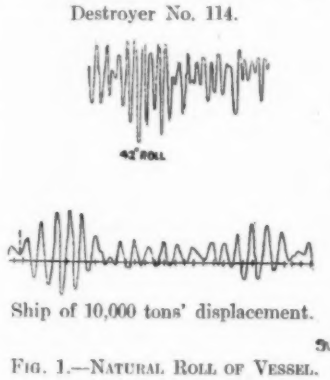

Fig. 1.—Natural Roll of Vessel.

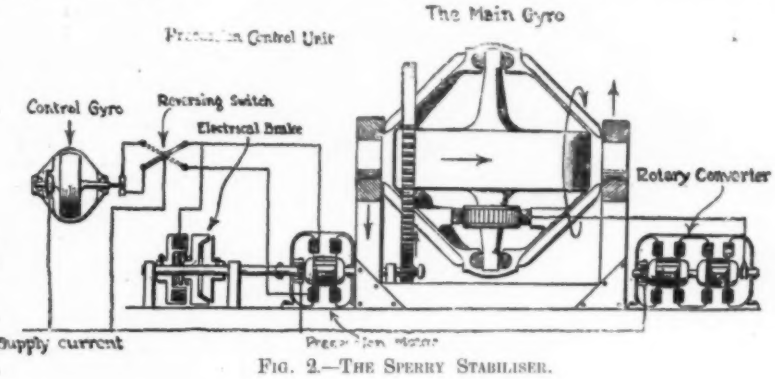

Fig. 2.—The Sperry Stabiliser.

About 25 years ago Sir John I. Thornycroft stated before this Institution that in his opinion ships could be prevented from rolling by means of forces which would neutralise the wave impulses, as distinct from attempts to destroy or reduce the rolling motion of the ship after it had obtained angular momentum. In the system under consideration Mr. E. A. Sperry has worked along these lines, and has produced a machine capable of opposing the roll-producing couples by a series of equal and opposite couples and with practically no lag between the roll-producing couple and the opposing stabilising couple. The magnitude of the forces which have to be impressed on the vessel are comparatively small, amounting only to the magnitude of the impulse received from a single wave as shown in the rolling diagrams. By thus preventing the roll from building up, the vessel is maintained within 2 deg. of the vertical.

Fig. 2 illustrates the system in diagrammatic form. The main stabilising gyro is shown with its spinning axis vertical, and so mounted that it can be precessed in the plane at right angles to the paper by means of the circular rack engaging with the pinion of the precession motor. The directions of spin, precession, and resulting couple are shown by the arrows. At the side of the diagram appears a small gyroscope with its spinning axis horizontal. This gyro is so mounted that the slightest acceleration of the vessel in the rolling plane will cause it to precess and close an electrical contact, which by means of suitable relay switches operates the main precession motor, and thus causes a stabilising couple to be applied to the vessel just sufficient to neutralise the impulse which was causing the angular acceleration in the rolling plane. Immediately this acceleration ceases, the control gyro stops the precession motor, and is ready to deal with the next wave impulse.

It is obvious that all gyroscopes sufficiently large effectively to stabilise a vessel must have considerable gyroscopical inertia. It is for this reason that the method of control is so important, as by its great sensitiveness it enables the wave impulses to be dealt with before the vessel has attained any considerable angular momentum, the precession motor overcoming the gyroscopical inertia and so keeping the stabilising couples in phase with the wave impulses

The stabilising gyro system may consist of one or two gyroscopes, according to the power required. If one gyro only is used, it is placed with its spinning axis vertical and mounted so that it can precess in the fore-and-aft plane of the vessel. If two gyros are employed, their spinning axes are placed horizontal, but the direction of spin of one gyro is opposite to that of the other. The precession plane is also horizontal, but the gyros are precessed in opposite directions, so that the stabilising couples act in the same direction.

The stabilising gyros are designed to apply a roll-quenching

couple sufficient to suppress the greatest single increment of roll that the waves would produce under conditions of free rolling. The precession velocity of the gyroscope is in practice made about 10 per cent. greater than the rolling velocity of the ship, and the maximum precession angle of the gyro is fixed at from 60 deg. to 70 deg. each side of the centre position. When stabilising a vessel against wave impulses which are just equal to its capacity, the stabilising gyro makes one complete movement in the precession plane from, say, 60 deg. on one side of the central position to 60 deg. on the other side in 9/10 of the vessel's natural half-period, although the vessel will not move more than 2 deg. from the vertical.

The intensity of the stabilising couple is proportional to the velocity of precession, and since the rate and direction of precession are always completely under control and capable of almost instantaneous reversal, we have a source of energy by means of which we can either apply a regular sinuous couple in the exact rolling period of the vessel, or an irregular series of stabilising moments, as may be required in order to counteract the roll-producing forces of the waves.

For a 10,000-ton steamer two cast-steel wheels were used, each 9 ft. in diameter, and each weighing about 25 tons. The wheels must be accurately machined all over and accurately balanced both statically and dynamically, which is done by means of balancing plugs. The rotor disk is not pierced in the centre, but is attached to its shaft stubs by means of collar studs. One of the shaft stubs carries the rotor of a three-phase A.C. motor for spinning the wheel, the stator being attached to the gyro casing. The peripheral speed of the wheels is about 500 ft. per second, and in order to reduce the driving power the wheels run in a partial vacuum.

Fig. 3, showing the two stabilising gyros being put on board the vessel and the precession bearings on the top of the gyro casings, illustrates the relative size of the ship and the stabiliser.

Fig. 4 is an autographic record of the behaviour of a vessel fitted with a stabiliser. First we see the roll when the vessel is allowed to oscillate freely, amounting to 22 deg.; the stabiliser is put into operation, and almost at once the vessel settles down to an amplitude of about 2 deg. As soon as the stabiliser is cut out up goes the roll again—in one instance to 31 deg., which the stabiliser promptly reduces to 3 deg.

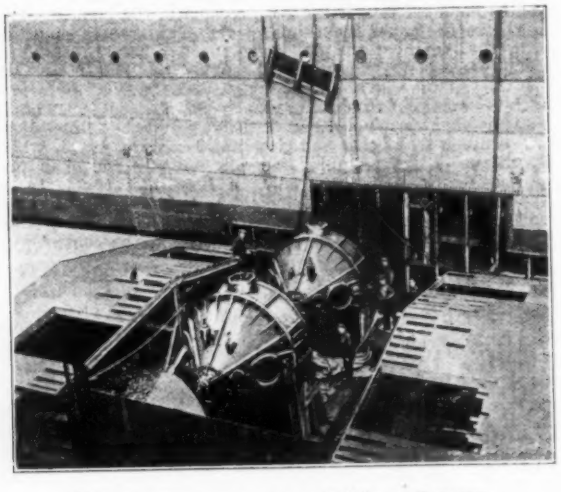

Fig. 3.—Stabiliser for a 10,000-ton Steamer.

The total weight of equipment necessary for a normal type of vessel amounts to only about 1 per cent. of the displacement.

By throwing over a switch the stabiliser can be made to roll the ship as shown in fig. 5. When a roll of about 10 deg. has been obtained in still water, the precession motor is stopped, and the natural frictional extinction curve of the vessel is obtained. By again rolling the vessel to 10 deg. and then reversing the precession motor and stabilising the vessel, we see the vessel brought to rest in one complete period.

By means of this test the actual roll-quenching power of the equipment can be obtained. This roll-quenching capacity is the number of degrees of roll quenched by the stabiliser per half period minus the number of degrees per half period shown on the natural extinction curve.

The advantages of stabilising a ship are many. It has been suggested that seas would break over the vessel; exactly the reverse is the case, the vessel becoming dry and much more seaworthy, simply because she never has any angular velocity to be destroyed when meeting a wave, and consequently merely rises and falls on the waves as they pass under her. When stabilised a vessel will make almost as good speed in rough weather as in calm, and will steer with very little helm because the yawing which always accompanies rolling is entirely eliminated. It is of course quite unnecessary to fit bilge keels to a stabilised vessel, with a consequent saving of as much as 6 per cent. of the total propulsive power of the ship.

The primary object of stabilisation, however, is not the reduction of the necessary propulsive power for a given speed, but the elimination of rolling *per se*. The steadier a ship is the better she is, and in the case of passenger vessels, naval vessels, and those ships which carry live stock, the advantage of being able to maintain the vessel practically on an even keel under all conditions is enormous.

The Sperry system has proved entirely practical and successful in operation. Installations in actual use ranging from

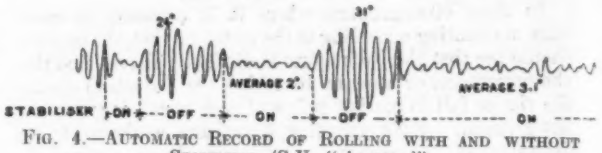

Fig. 4.—Automatic Record of Rolling with and without Stabiliser (S.Y. "Aramis").

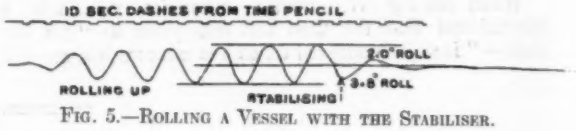

Fig. 5.—Rolling a Vessel with the Stabiliser.

vessels of 150 tons' displacement to 10,000 tons have demonstrated that this system is no longer in the category of an experiment, but that with a very moderate weight of equipment a vessel may be maintained within 2 deg. of the vertical, the power necessary for operating the equipment being a mere fraction of the energy dissipated by the extra resistance caused by the free rolling of the ship under the action of the waves.

ELECTRICITY AND AGRICULTURE.

The recently-published Report of the Departmental Committee of the Ministry of Agriculture and Fisheries on Agricultural Machinery (Cmd. 506) includes statements by Mr. J. F. Crowley, D.Sc., B.A., M.I.E.E., and Mr. T. Smith, A.M.I.E.E. The former drew attention to the possibilities of using electric power in agriculture, particularly in connection with the cultivation of the land. The advantages claimed for the use of electricity in agriculture, where motors and accessories were designed for the work they had to do, and the most suitable types were chosen, were as follows:—

Simplicity in design; first cost low; no expensive foundations required; motors readily started; greater portability; very little power absorbed when running idle; large overhead capacity to deal with fluctuating loads; small wear and tear; little care required in running beyond lubrication, and even turning torque and freedom from reciprocating movement and its accompanying shocks.

Dr. Crowley said that the German farmer before the war had at his disposal electrical material designed especially to meet his conditions. Several of the larger electrical manufacturing firms in Germany designed and manufactured ploughs suitable for working with the electrical apparatus they supplied. The development in Germany followed upon the erection of generating stations of considerable size. The development of electric ploughing and other work in agricultural districts helped the generating stations distributing in rural areas to maintain an even distribution of their load throughout the year. This enabled the central stations to develop and supply energy at a cheap rate. While attempts had been made to construct electric agricultural tractors, these had not yet passed the experimental stage, and had not been very successful; cable ploughing by two stationary motors or a stationary motor and winch had, however, had a very considerable measure of success on the Continent. Dr. Crowley said that the extent to which electricity could be used for ploughing and other farm work (apart from lighting and driving small stationary machines) depended almost entirely upon the erection of central power stations and the construction of a network of transmission lines. Electricity could, however, be employed only within a comparatively short distance of the transmission lines—a belt of five miles would probably represent the limit of efficient service—but subject to this limitation the method was a feasible one. He agreed that German statistics, and particularly pre-war statistics, could not be applied to this country, but he urged that there was a *primâ facie* case for investigation. The question was one of comparative cost, and it was necessary, before a decision could be made, to investigate all the factors as they applied in the United Kingdom.

Mr. Smith, who submitted written information and who has had 25 years' experience of the development of water

power and the application of electricity to farming, said that so far as the needs of the agricultural and rural community were concerned, electrical energy would be required mainly for operating farm machinery, corn-grinding mills, wood-working mills, and for lighting purposes. Closely connected with the farm industry was that of large creameries, small textile factories, seed dressing mills, together with heating and cooking by electricity. The demand for power on the farm was continually increasing. The difficulties in the way of a scheme the development of water power might not be be summarised as follows: (a) The unsuitability of existing laws regarding the uses of water; (b) the uncertainty as to whether the owner would secure compensation for the outlay on the plant on termination of tenancy; (c) the power given to adjoining riparian owners and "down stream" users to prevent others from altering in any way the flow of water in its ordinary channel.

Mr. Smith suggested that the State should take development work under its immediate control, as in the early stages of a scheme the development of water power might not be a paying proposition. Any scheme of work would involve at the outset comparatively heavy capital expenditure, towards the repayment of which the revenue during the first few years' operation would in all probability prove inadequate. It would be necessary ultimately to control water courses so that the properties of the streams could be utilised in the most efficient manner.

He also suggested that action by the State might be somewhat on the following lines: (a) Amending existing laws in their relation to the use of water, keeping in view the idea that its energy-producing properties should be utilised to the full as well as its irrigational properties; (b) taking over all sources of water, and assuming control from the mountain to the sea. Where energy was being wasted, the right for its development should be taken over or leased; (c) assisting in the development of power schemes by giving advice, preparing plans, supplying capital if necessary, and even installing the plant on a system of hire purchase; (d) making it compulsory to develop all sources of available power.

Mr. John Allen, O.B.E., Governing Director of the Oxford Steam Plough Co., Ltd., asked as to the possible application of electricity to cable ploughing in this country, said he was aware that in Germany electrical cable ploughing was successfully undertaken on farms specially laid out for the purpose, where the same land had to be so ploughed every year, but in this country, where the same field required steam ploughing usually only every four years, the application of electricity for the purpose would only be practicable if there were a development of large power houses and transmission systems all over the country.

Mr. J. Nugent Harris said he had made inquiries in both Denmark and Sweden, and he found that while the belligerent countries were occupied with the war, Scandinavian countries were equally busily occupied in developing their latent and other resources, as well as considering their available sources of energy. Sweden and Norway possessed an abundant source of energy in their water power. The respective Governments realised that by harnessing this power and developing electrical energy they would not alone benefit industries, but might revolutionise the most important industry of all—agriculture—and go far to solve the labour problem. At present Sweden possessed three great State hydroelectric stations, at Trollhätten, Porjus, and Alfkarleby, which jointly developed about one-third of the electrical energy of the kingdom. There were also three limited companies developing electrical energy. Electric power was transmitted by the State generating stations to Denmark, and this, being derived from water-power, was cheaper than the electricity developed in Denmark itself, which was produced (in the absence of water-power) from coal, peat, wood, sawdust, &c. In rural Denmark electricity was produced and distributed mainly on the co-operative system. As a result of the remarkable developments in the production of electrical energy, both Denmark and Sweden were rapidly being covered with a network of wires, and it seemed probable that before long practically every estate and farm in those countries would be supplied with electric power. Apart from the considerable reduction in manual labour brought about in connection with such operations as threshing, chaff and root cutting, elevating, pumping, &c., the provision of electric power had a great influence on the comfort and well being of the farm workers, and in inducing them to remain on the farms. Mr. Harris referred specifically to a visit he had made to a farm of 800 acres in the province of Sudermansland, in Sweden. On this farm practically every machine, except those used for cultivation, was electrically driven. The farmer stated that previous to the electrification of the farms he had to employ for his threshing operations five pairs of horses, 16 men and four boys, whereas under the electrified system, for the same work, he employed one horse, seven men and two boys. To this he added the enhanced value of the product, due to the smoother working of the electrical machinery, and he estimated a total saving of £5 a day on this farm in respect of the threshing operations. Further, it was possible to thresh much earlier, thus obtaining an enhanced price for seed corn and avoiding injury to the stack by rats and mice. The farmer estimated the cost of the whole electrical plant on his farm at about £1,250, and he was convinced that, even with the high prices prevailing when it was installed, the plant not only yielded interest on the outlay, but would in about 15 or 20 years pay for itself. Mr. Harris had visited one of the co-operative supply stations in Denmark, and was informed that it was being tapped by about 3,000 farmers, besides shopkeepers and others, and that the demand was so great that another station of greater capacity was being erected.

Mr. Jones-Davies, J.P., suggested that the possibilities of harnessing water-power to generate electricity on the farms should be explored. He had been struck very forcibly by the large amount of power which was being wasted in the Welsh streams.

Mr. J. R. Bond, B.Sc., pointed out a similar waste of power in Derbyshire.

The Committee includes among its recommendations one that the Ministry of Agriculture should further consider the question of the application of electricity to agricultural operations, including the working of light railways and the lighting of villages and farmsteads.

POWER FROM BLAST FURNACE GAS.

At Newcastle-on-Tyne, on March 22nd, Mr. S. H. Fowles's paper (an abstract of which appeared in our issue of March 26th) was read and discussed before the North-Eastern Centre of the Institution of Electrical Engineers.

Mr. A. P. Pyne opened the discussion, and said the author's figures might err on the optimistic side a little, but his main contentions were absolutely correct. He supported the author's paper by supplementary remarks, somewhat coloured by the discussion that had recently taken place in London. He found, for instance, that an impression existed in the minds of more than one speaker that blast-furnace gas was being made good use of in this country; that the iron masters were fully alive to the advantages of properly employing the waste gases, and that they had no surplus available for outside purposes. It was one thing to be alive to the value of a product, however, and quite another to utilise it properly when to do so many problems had to be solved, and when considerable capital outlay was involved. The fact remained that a considerable source of power had been largely wasted in the past, and they had had to rely on the Germans to show them how to utilise it efficiently. The advantages to be derived from cleaning the gas were always considerable, and sometimes enormous, and the cleaner the gas the better. When clean gas was used a large surplus was available for purposes other than at the blast furnaces. He pointed out that in the case of the power station described by Mr. Fowles, the total power needs of a large steel works, shipyard, engine works, boiler works, and several other establishments were supplied, and a considerable surplus remained available. The gas not required by the blast furnaces could be used for generating electricity either by means of steam boilers and turbo-generators or directly by gas engine generators. Given the right plant, the gas engine proposition was equally as reliable as was the steam proposition. Steam plant was lower in first cost than was the gas engine plant, but having regard to the greater economy of the latter its adoption was fully justified provided suitable up-to-date plant was installed. Neither gas engines nor gas cleaning plant had reached finality, and the developments stopped by the war would in all probability be resumed. Exhaust gases might be used for providing the steam in the preheaters of the Halberg-Beth plant or driving steam turbo-pumps for the scavenging plant. Other economies of a similar character remained to be investigated. With regard to gas-cleaning plant great scope existed for developments. The electro-static plant had not in this country proved itself superior to the filter plant. There was also the Swartz disintegrator plant, of the wet type, which showed promising results, combined with reliability and simplicity, but did not lend itself to potash recovery. A very simple process seemed to be meeting with success in America—the Kling Weidner system, which was dry, and involved no loss by sensible heat. Gas blowing engines for some blast furnaces had frequently to run for considerable periods at from half to three-quarters load. For this purpose the 2-cycle engine possessed advantages over the 4-cycle, inasmuch as the use of scavenging plant with separate gas and air pumps resulted in higher efficiency and better control at the lower speeds than was the case with the 4-cycle engine.

Mr. Waites welcomed the paper as being especially interesting to those concerned with the generator side of the question. He referred to the 30 per cent. efficiency of the engine, and questioned whether it compared favourably with the turbine.

Mr. Hewson said he viewed the matter from the point of a blast-furnace engineer. Hitherto all the gases leaving the blast furnace had been utilised—or wasted—on the blast furnace and auxiliary plant, and what was used was mostly wastefully used. When it was remembered that there were 300 blast furnaces in this country in operation, it was easily seen what a serious loss of fuel there was going on, whereas if they took the heat energy from the furnace top there would be 7½ million tons of coke available for other purposes. He thought all concerned—the gas engineer and the elec-

trician—should work together for the general good in the utilisation of that waste heat and power. He explained that stoves could work at a higher temperature with clean gas than with dirty gas.

Mr. Rosen said the paper seemed to have been written from the gas engine point of view, and he asked if turbines had been considered for use with gas. The question of floor space in a power station seemed a serious matter. He thought some of the figures of cost were higher than would be the case if a turbine were installed.

Mr. Heslop also spoke in favour of the turbine as being more economical; the standing charges for gas would be very much higher. The cost of the gas plant was put down at £165,000, that of the turbine he put at £37,000. The capital charges at 15 per cent. for the gas engine were £24,750; that was equal to 0.17d. per unit; the capital charges for the turbine at 12 per cent. were £4,400 or 0.03d. per unit.

Mr. Fowles, in reply, said it was not a question of ranging the gas engine against the turbine, but it was a question of having the whole important matter thoroughly discussed by all parties interested.

REVIEWS.

Principles of Transformer Design, by Alfred Still. Pp. xii +216; 67 figs. London: Chapman & Hall, Ltd. Price 10s. 6d. net.

It is always a pleasure to make acquaintance with a new book by Prof. Still. His writings have a character of their own, and have none of the flavour of compilations based on other people's ideas which attaches to many modern text-books, especially those which cover a wide ground in the field of electrical engineering practice. Prof. Still always seems to approach his subject in an original way, which he has thought out for himself and has reduced to the simplest terms of logical reasoning; he never allows conventional rules or subsidiary matters of any kind to obscure the essential and fundamental principles governing the matter under discussion.

The routine work of the designer of standard types of electrical machinery is generally so largely based on sets of formulæ and rules and reference to tables of data obtained from previous experience that it is apt to become conventionalised and more or less stereotyped. As a consequence, rules of procedure are often followed because they have become habitual and are found to lead to satisfactory results within the range of machines with which the designer is concerned.

In this way it is only natural that many young workers in the designing office get into the habit of using rules and formulæ without troubling themselves to understand—or at least to keep in mind—the fundamental principles which underlie the rules they are constantly using. Obviously, this may lead to unfortunate results when some case arises where the conditions are no longer those of the assumed standard practice, and, in any case, the young designer who slips into such habits is not likely to be in a position to suggest improvements or economies in the machinery with which he deals.

It is somewhat in consonance with the practice to which we have been referring that a number of books have appeared containing rules and tables of data which seem to the inexperienced youth to contain all that is necessary to enable him to prepare designs for any standard type of machine for which he may be asked. When, as is often the case, the full reasons and theoretical considerations underlying the data and formulæ are not given, it is evident that the young engineer may be greatly deceived in his confident use of the results. Such books may, of course, be of the utmost value to the experienced designer, but to him alone.

On the other hand, there is a type of text-book which, while professing to be a book on design, is, in fact, mainly a discussion of the theoretical principles on which design should be based without a full and detailed treatment of the practical matters which would enable the student to carry out an actual design of a machine capable of meeting the actualities of commercial use.

Prof. Still seems to have hit the happy mean between these two extreme types, and has produced a book which, while dealing clearly and thoroughly with principles, does not pass over the practical matters which need to be dealt with when designing a transformer which is not to be merely a college exercise but is to be capable of working efficiently under the conditions of real life.

The book is written primarily for the advanced college student, but we have no hesitation in saying that many a young engineer engaged in practical work as a designer will find a great deal in it which will help him in his work, and make him a better designer.

Turning to a more detailed description of the contents of the book, the first chapter contains a clear summary of the elementary theory of the simple transformer, and gives an outline of the construction of the main types, with a calculation of the mechanical stresses set up in the windings and clear diagrams of the methods adopted for giving the coils adequate support.

Chapter II deals with insulation, and summarises the most important principles of this difficult subject in such a simple and logical way as to give an excellent insight into the problems of designing the insulation of windings and terminal bushes. References to more specialised publications enable the student to seek further information on special points, but as a clear presentation of the main principles of insulation design this chapter is quite admirable. Beginning with the conception of the dielectric circuit, the author proceeds to apply the principle to the simple condenser and condensers in series, later on showing how the various forms of insulator used in practice are to be studied in the light of the theory thus discussed. The results obtained by the consideration of these fundamental principles, together with the estimation of surface leakage, are later on applied to the calculation of various forms of terminal bushing. Practical rules are given for the insulation of transformer windings and the clearances necessary in air and with oil immersion.

In Chapter III, devoted to the efficiency and heating of transformers, we have first the usual calculations of efficiency and losses, with some useful curves and figures obtained from actual practice and then a careful and detailed treatment of the flow of heat in the transformer, cooling medium and case, with the various methods adopted for cooling and constants or curves given for such practical matters as the effective radiating surface of corrugated wrought-iron cases with various forms of corrugation.

Chapter IV deals with magnetic leakage, reactance and the determination of regulation. There is perhaps less scope for originality of treatment here, but the chapter is quite worthy of the standard set by the rest of the volume.

The next chapter contains a description of the procedure to be adopted in carrying out an actual design, and includes the calculations for a 1,500-K.V.A. single-phase transformer, with detailed specification and a complete tabulated design sheet drawn up in a useful form with full description of the methods used for obtaining all the constants and data enumerated on the sheet.

The final chapter discusses transformers designed for special purposes, *e.g.*, for very large currents at low pressure, constant current transformers, instrument transformers, auto-transformers and induction regulators.

Unfortunately there is no discussion of the important subject of costs—a matter which is often of special significance in connection with transformer design, even when we use the term "design" in its most restricted sense. The financial aspect is, of course, the determining factor in the adoption of transforming devices with regard to type, capacity and location when the "design" of schemes is being approached in the broader sense.

In conclusion, the reviewer can cordially recommend this little book to all students and young electrical engineers who are at all interested in the subject of transformer design. Few of those who read it will fail to gain fresh information and clearer insight into the subject from a study of its pages. Its perusal is made the more pleasurable by the excellence of the diagrams, drawings and letter-press, while the two indices and the list of symbols employed add much to its value for purposes of reference. C.F.S.

Automobile Batteries. By H. H. U. Cross. Pp. v + 101; 24 figs. London: E. & F. N. Spon, Ltd. Price 4s. net.

The author of this interesting little volume leads off with the undeniable statement that "the modern motor-car is becoming more 'electric' every day." Since this electrical equipment always includes a battery which is generally the least understood and most severely tried portion of the whole car, there is no doubt that practical information such as is contained in the volume under review is badly needed. The book contains 100 pages divided into five chapters, and a short appendix of technical terms, &c., the sub-title being, "A practical handbook on the construction, charging, repair, and maintenance of ignition, starting, lighting, and electric vehicle batteries: 'dry,' lead, and alkaline types." On the whole, this rather ambitious field is fairly well covered as far as it can be in a book of the size, although very little is said of the special problems relating to electric vehicle batteries, about which alone a whole volume could be filled.

Chapter 1 deals mainly with the primary battery in its 'dry' form as used a good deal in America as a stand-by for the ignition system, though not much in evidence in England. A recent contributor to the Electrical Review remarked that on his car, an American, the reserve battery of five dry cells had dried up three years ago (literally "dry" cells in this case), and as it was never required, he removed it and its wiring bodily; and a similar fate probably attends many other spare dry batteries. However, the action of the primary cell is interesting, and is useful to know in so far as it forms the basis of the action of the secondary battery. This action is well explained, and a good deal of practical information given as to the use, testing, and capabilities of dry batteries under various conditions. Some actual figures showing the internal resistance of dry batteries in various sizes might have been included for the sake of comparison with corresponding figures relating to secondary batteries.

Chapter 2, on the lead storage battery, contains clear information on the principles, theory, and construction of this type, all of which is useful. A table is given from a manufacturer's catalogue showing the enormous currents that are momentarily

called for from the battery at starting, but no discharge curves are reproduced to indicate the discharge from automobile batteries under various conditions of load. A reference might have been made to the "block" form of construction.

Chapter 3 relates to charging batteries, not under running conditions on the car, but separate charging in the garage or otherwise. Full instructions are given for this, as to the first and subsequent charges, mixing acid, testing, &c. The different methods of charging from dynamos, from primary batteries, and from house mains are also discussed. Charging from alternating current supplies is also mentioned, and various rectifiers described, though the kind most commonly used, the Nodon valve, is only dealt with in a short paragraph.

Chapter 4 is devoted to the repair of lead batteries, and this subject is dealt with very fully. Detailed instructions are given for the repair of all parts of the cell, the treatment of sulphated plates, &c., and the fitting of new plates into a cell.

In chapter 5 an interesting and instructive account is given of the alkaline battery, both the American Edison and the Swedish NI-FE types being referred to. The theory and construction are explained, and general notes given on the subject. In the comparison of the two batteries, acid and alkaline, one statement given is open to misapprehension. It is stated that the alkaline type has "double the capacity weight for weight." The author doubtless means capacity in ampere-hours only, but if watt-hours are taken for comparison, as they should be, the statement is by no means correct.

A few diagrams are given, and these are clear and well drawn, but a good many illustrations are from catalogue blocks, some being rather "back numbers," which tend to give the book a somewhat out-of-date appearance not justified by the text.

A few typographical errors occur, mostly unimportant, but "Nocton" for Nodon valve, on page 60, should have been corrected, and also the statement on page 98 that an accumulator is the synonym of a "strange" battery.

The comments given above are by no means intended to disparage the value of this book, which undoubtedly contains much valuable and badly-needed information, particularly to the student or to those undertaking repairs to batteries. It is clearly written, and the matter is well arranged; the type is easily read, so that the information can be assimilated without undue effort. It bears the stamp of being written by one having a practical and first-hand knowledge of his subject.

F. H. Hutton.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Safety Hand Lamp.

Mr. George J. Duckett, of "Hillcrest," Oakbank Avenue, Moston, Manchester, has developed a new form of portable lamp designed to prevent unauthorised interference by introducing a locking arrangement so that the inside of the lamp cannot be got at by other than authorised persons.

The ring carrying the safety cage is notched on the threaded portion, and engaging with the notches is a catch A C, fig. 1. The catch is pivoted, the opposite end forming an armature A, and this in turn is held in such a position by the spring as to ensure that the catch A C is always in engagement with the notches in the safety cage ring.

It will be seen that it is impossible to unscrew the cage ring until the catch has been disengaged, and for this purpose an electro-magnet E M is employed.

The case of the lamp, which is of ferrous metal, forms one pole of the magnetic circuit, and in order to restrict the lines of force through the armature A the iron plug I P is surrounded by non-magnetic metal.

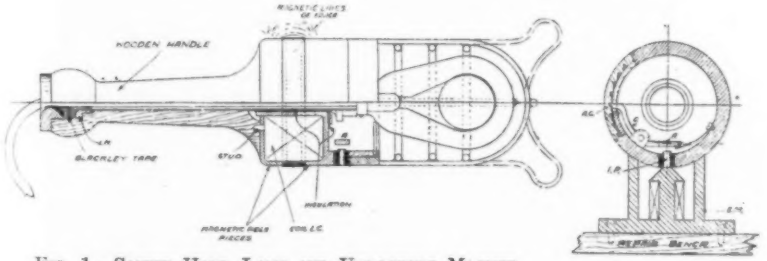

Fig. 1.—Safety Hand Lamp and Unlocking Magnet.

When the electromagnet is energised the lines of force are restricted, and are directed through the armature to the case of the lamp. As the armature is free to move it is drawn towards the iron plug, and the catch is withdrawn from the notches in the cage ring.

In order to facilitate quick repair or renewal of lamps in the workshop, the electrician in charge can carry about with him a small electro-magnet supplied with an adapter plug.

The body portion of the lamp has been constructed in the form of an electro-magnet, in order that the lamp may be placed near or against any magnetic material, and held in position, until forcibly pulled away by hand.

The holder is insulated from the metal portions of the lamp, which are held in position by the locking nut L N at the base of the handle.

In order to overcome any excessive pull on the terminals of the lamp the flexible jumper is locked by binding it round with adhesive tape, after which it is compressed by a locking nut.

A New Vibration Galvanometer.

A new form of vibration galvanometer is described in a recent scientific paper (No. 370) of the U.S. Bureau of Standards (fig. 2). In this device the electromagnet is placed outside the gap of the permanent magnet, but in a position in which an appreciable amount of flux from the latter passes through the cores of the former. The arrangement is the same in principle as earlier types, the chief difference in detail being the weaker field to which the core is subjected. The two principal advantages of putting the electro-magnet outside are: First, the instrument will be most sensitive when the core is working at the point of maximum differential permeability, and secondly, with low-frequency vibrators, which must be of very small diameter, the effect of a strong magnetic field upon the frequency of the vibrator introduces practical difficulties in tuning, since the magnetic forces combine with the elastic force to change the total restoring force, thus altering the frequency. The best results have been obtained with cores of sheet silicon transformer steel. The vibrator is mounted on a small soft steel base, and is held in place magnetically by merely placing the base on the face of the magnet. For convenience in changing vibrators for different frequencies, an aluminium wire handle is fixed in the base.

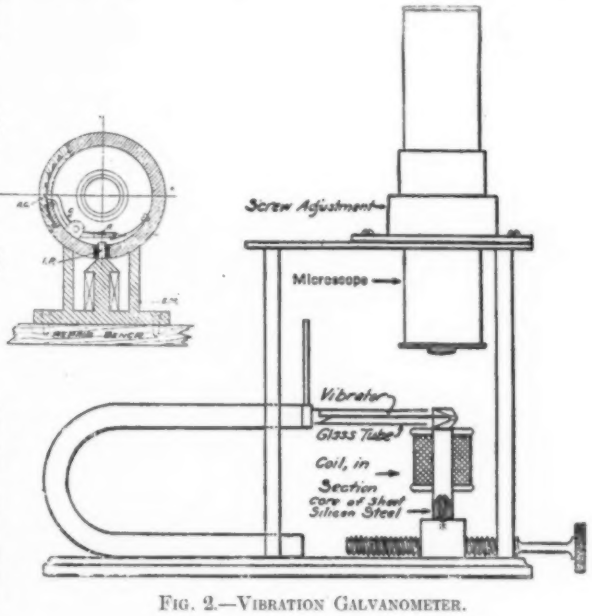

Fig. 2.—Vibration Galvanometer.

If the vibrator is polished and illuminated by a horizontal beam of light, a sharp line of light may be obtained in the microscope. Satisfactory readings may also be made by viewing the wire in the ordinary way.

The Woods Earthing Device.

A simple device for earthing pipes and lead-covered wires of all sizes has been put on the market by Messrs. Faulkner and Co., of 5, Market Street, Manchester. It consists of a strip of bare copper, with holes punched in it at 7/16-in. centres. By lapping the strip round a pipe and drawing it tight with a 3/16-in. bolt and nut, through the holes that serve best, with specially shaped washers, an excellent grip

and a satisfactory contact are obtained with the minimum of trouble. The same strip may be clamped to any number of adjoining pipes, and serves also as a terminal to which an earthing wire can be clamped, any desired length being cut off the strip to suit the requirements.

A Loud-speaking Marine Telephone.

Among the latest manufactures of Messrs. Siemens Bros. & Co., Ltd., Palace Place Mansions, Kensington Court, W. 8, is a series of loud-speaking marine telephones, one of which is illustrated in fig. 3. This instrument is provided with a

Fig. 3.—Loud-speaking Marine Telephone.

standard watertight capsule transmitter and two sound trumpet tubes. It is unnecessary to raise the tubes to obtain loud-speaking effects, but in particularly noisy situations the tubes, which are fitted with pneumatic rubber ear pads, can be raised to the ears to exclude external sounds.

NEW PATENTS APPLIED FOR, 1920.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

9,590. "Electric lamps for motor cars, &c." F. Hanmer. April 6th.

9,612. "Carrier for electric-lamp, &c., shades, &c." A. P. Rutherford. April 6th.

9,616. "Eectrical resistance apparatus." C. J. Margerison and F. J. Shenton & Co. April 6th.

9,629. "Electric relays." M. D. Dimitrievitch. April 6th.

9,631. "Electrical change-over switch apparatus." T. Rabjohns and G. Vickery. April 6th.

9,647. "Telephone-call recorder." H. M. Stevenson. April 6th.

9,670. "Permanent magnets and permanent-magnet motors." S. I. Hitchcock. April 6th.

9,673. "Telephone systems." Automatic Telephone Manufacturing Co. April 6th. (United States, August 20th, 1919.)

9,679. "Fuses for electric currents." J. T. Callaway and R. F. Crouch. April 6th.

9,680. "Dynamo-electric systems for automobiles." British Lighting and Ignition Co. and E. O. Turner. April 6th.

9,681. "Electric switches, sockets, &c." H. J. Cash and G. Gorringe. April 6th.

9,686. "Electric furnaces." E. Assie. April 6th. (France, August 9th, 1917.)

9,687. "Electric welding." Wilson Welder & Metals Co. April 6th. (United States, April 22nd, 1919.)

9,693. "Adjustable standard for electric lamps." L. S. Hammarback. April 6th. (Sweden, April 4th, 1919.)

9,707. "Direct-current dynamo-electric machines." B. J. Shillito. April 7th.

9,708. "Step-by-step mechanism for electric motor starters." C. C. Garrard, A. H. Railing and W. Wilson. April 7th.

9,721. "Spark plugs." L. S. Flatau. April 7th.

9,742. "Electric lighting." W. Charles. April 7th.

9,750. "Automatic device for compensating for effects of temperature in electrical circuits." F. W. Curtis. April 7th.

9,763. "Electric measuring instrument." E. C. R. Marks. (Nagel Electric Co.) April 7th.

9,790. "Spark plugs." A. E. Watts. April 7th.

9,800. "Arrangements for transmission of electric currents by liquid conductors." F. Aigner and R. Erban. April 7th. (Austria, March 11th, 1919.)

9,801. "Magneto-electric couplings." R. Erban. April 7th. (Austria, March 13th, 1919.)

9,809. "Sparking plugs." T. B. Broad and S. J. Plummer. April 8th.

9,813. "Commutator for Ford cars and Fordson tractors." A. W. Fellows and W. A. Gardner. April 8th.

9,816. "Means for supporting porcelain, &c., electric-light fittings." G. P. Dennis. April 8th.

9,822. "Flexible pendant electric-light fittings." W. Broadbent. April 8th.

9,852. "Brush-lifting and short-circuiting means for induction motors." A. Parkinson. April 8th.

9,860. "Electrical generating systems." Industrial Research Corporation. April 8th. (United States, April 8th, 1919.)

9,861. "Electrical generating systems." Industrial Research Corporation. April 8th. (United States, April 28th, 1919.)

9,867. "Ventilating systems for dynamo-electric machines." British Thomson-Houston Co. (General Electric Co., U.S.A.) April 8th.

9,884. "Electric soldering apparatus." E. Martin. April 8th. (France, April 8th, 1919.)

9,899. "Combined electric switch and meter for motor-cycles, &c." Powell & Hanmer, W. A. Shepherd and E. F. Wilson. April 8th.

9,900. "Electrical cut-outs." Powell & Hanmer, W. A. Shepherd and E. F. Wilson. April 8th.

9,929. "Electric heaters." J. K. Soden. April 9th.

9,950. "Heating chamber for removing necks of lamp bulbs, &c." P. V. Castell-Evans. April 9th.

9,963. "Electric motors of the unwound armature type." Barr & Stroud and J. W. French. April 9th.

9,968. "Sparking plugs." A. W. Armstrong. April 9th.

9,974. "Dynamo-electric machines." British Thomson-Houston Co. and F. P. Whitaker. April 9th.

9,997. "Electric furnaces." W. E. Moore. April 9th.

10,061. "Telegraph circuits." A. Orling and Orling's Telegraph Instruments Syndicate. April 10th.

10,062. "Alternating-current motors." F. Punga. April 10th. (Germany, March 26th, 1919.)

10,068. "Electrical measuring instruments of the moving-coil type." R. F. Hamilton, R. F. Hamilton & Co., F. S. J. Pile and H. Smith. April 10th.

10,105. "Electrical switching-apparatus." J. F. G. Hartmann. April 10th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

12,373. Electrically-driven gramophones. D. Branson. August 29th, 1917. (140,108.)

1918.

6,029. Sparking plugs. Clerget, Blin et Cie. January 19th, 1917. (116,265.)

14,106. Primary galvanic batteries with unalterable electrolyte. E. W. Jungner. September 4th, 1917. (118,843.)

14,458. Telephone apparatus. M. Latour. September 5th, 1917. (140,123.)

17,514. Telephonic apparatus. M. Latour. October 3rd, 1917. (Addition to 140,123.) (140,133.)

18,754. Dynamo-electric machines. British Thomson-Houston Co. and F. P. Whitaker. November 15th, 1918. (140,134.)

20,375. Electric muffle furnaces. A. Imbery. June 4th, 1919. (140,138.)

21,638. Group switching arrangement for automatic or semi-automatic telephone exchanges. C. A. W. Hultman. December 24th, 1917. (121,957.)

1919.

3,231. Electrodes for vacuum discharge devices. British Thomson-Houston Co. (General Electric Co.). February 10th, 1919. (140,166.)

3,808. Sparking plugs for internal-combustion engines. V. Bonde. February 15th, 1919. (140,172.)

4,214. Electric switches. J. A. Crabtree. February 20th, 1919. (140,179.)

4,215. Electric switches. J. A. Crabtree. February 20th, 1919. (140,180.)

4,219. Electric switches. J. A. Crabtree. February 20th, 1919. (140,181.)

4,221. Electrical switches. J. A. Crabtree. February 20th, 1919. (140,182.)

4,710. Electric motor cars. K. H. O. Lubeck. February 25th, 1918. (123,767.)

7,981. Machine for winding magneto-armatures, coils and the like. R. W. Humphrey. March 31st, 1919. (140,215.)

8,177. Excitation of dynamo-electric machines. British Thomson-Houston Co. (General Electric Co.). April 1st, 1919. (140,220.)

8,733. Means for preventing sparking in appliances for making and breaking electric circuits. H. H. Hill. April 7th, 1919. (140,227.)

15,085. Regulating systems for alternating current circuits. British Thomson-Houston Co. (General Electric Co.) June 16th, 1919. (140,285.)

18,001. Magnetos. J. H. Runbaken and W. Torrance. July 18th, 1919. (140,298.)

21,829. Contacts for electric switches, fuses and the like. H. J. Dean and W. Redmayne. September 5th, 1919. (140,318.)

24,575. Electrical protective devices. Western Electric Co. (Western Electric Co.) February 14th, 1919. (Divided application on 135,389.) (140,332.)

27,904. Electric lighters. B. L. Dechelle. March 22nd, 1919. (Addition to 129,653.) (140,346.)

29,889. Electromotor with self-contained reducing gear. H. Schroder. September 16th, 1914. (136,153.)

A Note We O,Cl. — "SLI Humour.—In one of the lighter columns of the *Commercial Motor* we recently noticed the remark, 'Let's have a squint at your X-eyed battery.' Evidently this is intended to test our gravity. We wonder whether there is any charge? Probably the answer is in the negative, and our Publicity Manager's capacity for free advertisement cannot be reckoned in ampere-hours. . . . He might tell the *Commercial Motor* that we realise that if the power behind the motor is in the Exide battery, the power behind the *sells* is in the Advertisement." —From the *Chloride Chronicle.*